Composite Mock-Up Assembly

- Position the seat frame in the upright position (see Figure A-1 of Annex A).

ILS NOTE 9: *See notes below on alternate directions for assembly of mock-up. Also note that the balance must be tared with the frame and clips before assembly of the specimen.*

- Lay down the cover fabric (and any fire barrier material) flat and face up on the table.
- Fold the two sides of the larger section fabric (from the 6 in cutout upwards) over the face of the fabric.
- Hold the two sides of the folded fabric and insert it under the horizontal rod. Pull the inserted fabric out from behind the seat mock-up frame until the cutout line is lined up with the horizontal rod.
- Re-insert the folded fabric over the rod and pull it out from the front of the frame.
- Line up and pull both the top and bottom sections of the fabric such that the cutout line is lined up with the metal rod and the fabric is flat and free of folds and wrinkles.
- Place the larger foam block flush against the back metal frame on the fabric.
- Wrap the larger portion of the fabric around the foam and secure it to the backside of the frame using metal clips.
- When the back section is completed, place the frame down such that the back of the frame is on the table.
- Lift the smaller portion of the fabric up and lay it on the back cushion.
- Place the smaller piece of foam with the ¾ in side flush with the seat section of the metal frame and press against the back block.

ILS NOTE 10: *This may be a typo ("the _ in side"), but since our seat pieces are the same dimension in two directions, it doesn't really matter which is the "height" and which is the "depth."*

- Wrap the smaller section of the fabric all around the foam and secure it to the frame using metal clips. Re-position the assembly in the upright position.
- Ensure that the fabric is tight and under uniform tension at all locations to eliminate air gaps between the fabric and the foam. Do not allow a gap exceeding 3 mm (1/8 in) along the seat/back crevice.

ILS NOTE 11: *The procedure to construct the furniture mock-up in this write-up is somewhat confusing (especially with regard to inserting the fabric). Following is an alternate procedure with the same final objective:*

- *Position the mock-up seat frame in the upright position (see Figure A-1 of Annex A).*
- *Insert the shorter end of the pre-cut fabric face up under the horizontal rod of the frame and pull through until the fabric notches meet the rod. The interliner, if needed, should be assembled in the frame at the same time as the fabric and in the same manner, with the interliner on the inside of the fabric.*
- *Insert the longer end of the pre-cut fabric face down over the top of the horizontal rod on the frame and pull through.*

- *Place the larger piece of foam, plus batting if required, behind the interliner, if present, and the fabric, and flush against the metal frame of the seat back. Secure the fabric/interliner with clips.*
- *Lay the frame on its back, and place the smaller piece of foam, plus batting if required, under the fabric and interliner. Secure the seat portion of the mock-up with clips. Re-position the assembly in the upright position.*
- *Ensure that the fabric is tight and under uniform tension at all locations to reduce air gaps between the fabric and the foam. Make changes to improve the shape of the final product, if necessary. The fabric should be tight while minimizing deformation of the filling materials. Do not allow a gap greater than about 3 mm (1/8 in) along the seat/back crevice.*

ILS NOTE 12: *When the specimen contains only fabric and foam, it is relatively easy to assemble the pieces with uniform tension and essentially no "gap" between the seat and the back. Ensure that there is no deformation of the foam when securing the fabric in place. With batting and/or interliner, it is more difficult to create uniform tension and nearly impossible to measure the gap between seat and back. For the ILS, the objective is to have the seat and back flush with one another at the crevice, with the absolute minimum gap for any given assembly. The instructions "ensure that the fabric is tight and under uniform tension at all locations" and no "air gaps" should override any measurement of the width of the gap.*

<u>5.8 Test Procedure</u>

Have a means for extinguishing the specimen close at hand. A hand-held carbon dioxide extinguisher is adequate for most specimens; however, a water spray system should be available as a backup, in case the carbon dioxide fails to completely extinguish the fire.

ILS NOTE 13: *While a water spray was recommended in earlier drafts, there are several disadvantages to such type of extinguishment. A back-up CO_2 extinguisher should be sufficient. The disadvantages of using water are as follows: 1) it is messier than CO_2, 2) it increases the chance that the load cell or other instrumentation might be damaged, 3) it affects the "final" weight of the specimen, if that measurement is desired.*

Pretest:

1. Tare the balance with the empty metal test frame and metal clips or, if the balance does not have tare capability, weigh the metal test frame and metal clips together, and record the weight.

ILS NOTE 14: *Obviously, this instruction has to be followed before the assembly of the composite, as described above.*

2. Assemble the specimen on the metal test frame using the pre-weighed clips.
3. Record the weight of the total assembly in order to determine the initial weight of the specimen either directly (if tared) or by subtraction (if not tared).
4. Calculate and record weight corresponding to 96% of initial weight of test specimen.

ILS NOTE 15: *See additional instructions accompanying the "Results" sheet for information on the calculations necessary for the ILS.*

Lighting the igniter flame:

Open the butane tank slowly and light the end of the burner tube. Adjust the gas flow to the appropriate rate (see Annex A) and allow the flame to stabilize for at least 2 minutes.
ILS NOTE 16: *If the burner tube and hose have been left idle (i.e., no flowing butane) overnight or if the assembly has recently been taken apart, it may take longer than 2 minutes (some have reported 15 minutes) to stabilize the igniter flame. If the butane pressure has been set as required (see Annex A) and the flow rate is monitored as specified, then the flame height should be as noted. The flame height is insufficiently precise to be used as the sole measurement. If the flame height is substantially different from that stated, either the butane flow has not yet stabilized, there is air in the tube, or something is wrong with the set up.*

Starting and performing the test:

1. For manual timekeeping of each individual ignition, start the clock at the same time the burner tube is moved into starting position. For automatic timekeeping, start the data collection at least 30 seconds before the igniter is moved into position on the specimen in order to collect baseline data. In the case of automatic recording (e.g., chart recorder or computer), provide for a signal to the recorder to mark the actual start of the test.

ILS NOTE 17: *Timekeeping is not meant to be an onerous task, but it is one of the most important measurements taken in this protocol. We must provide for data collection from the start of the experiment (i.e., upon application of the pilot flame) to the end. Some computer-based systems may or may not respond instantly to pressing a key and therefore could record a time that is not the true test time. On the other hand, starting data collection before starting the test, and not having a way to exactly indicate the "start" on the computer could result in an error, also. Consider the following instructions to ensure that time keeping accurately represents the progress of the test.*

1) For computer recording, the operator must verify that the computer will record an accurate mass reading at zero time without obtaining baseline readings. If not, he/she should start the computer 30 s prior to starting the test in order to obtain a baseline. Count down the last 10 s so that the igniter will be applied exactly at "0" run time. Edit the final Excel spreadsheet to remove the preliminary data so that the mass results start at 0 time and the correct initial mass. As an alternative to the computer recording the initial mass, the operator can manually obtain the initial mass reading and edit the first data point on the Excel spreadsheet to be equal to the observed mass.

2) For manual recording, the operator should record the initial, stabilized mass as the "zero" reading. There are at least two methods of manually obtaining mass readings every 10 s during the test: 1) the operator can mount a large, digital clock close enough to the read-out of the load cell to permit *simultaneous viewing of both the time and mass; or 2) one operator can call out times while another watches the load cell readings (the latter being the preferred method). It is NOT SUITABLE for a single operator to watch a small clock or stopwatch and attempt to accurately read the mass (which may be changing rapidly).*

2. For manual data collection, record the weight of the specimen at least every 15 seconds. For automatic data collection, record data at a constant interval between 3 and 6 seconds.

ILS NOTE 18: *For the ILS, all labs shall obtain data at least every 10 seconds.*

3. Position the lit burner tube from the side of the test specimen, parallel to the crevice between the vertical and horizontal parts and in contact with both parts, so that the end of the igniter is at the center of the test specimen equidistant from either edge.

ILS NOTE 19: *For this test method, the burner tube is held in place manually. Fortunately, the required length of straight tubing fits nicely into the junction of the seat and back of the test specimen and can be held stable with very little pressure This technique should be practiced, with a lit burner and disposable specimen, prior to the ILS, until application and removal of the igniter can be done smoothly, and without unnecessarily disturbing the load cell. Care must be taken to set the ignition tube in place at the start of the experiment without touching either the back or the seat along the way.*

4. For each ignition, apply the flame for 20 ± 1 seconds, then immediately remove ignition source.

ILS NOTE 20: *Care must be taken when "immediately" removing the igniter tube, so that the flames on the specimen are not disturbed and so that the ignition source does not touch either the back or seat cushion. With practice, the tube can be withdrawn immediately, but with care.*

Note: The weight of the specimen will appear to increase due to pressure when burner tube is in contact with the mock-up. Ignore this temporary weight increase in assessing weight loss of sample.

5. Observe the specimen for evidence of ignition on the cover material or in the interior of the mock-up cushions for 10 minutes.
6. If the first specimen self extinguishes and the specimen is re-useable, apply the second ignition equidistant between the center of the seat/back crevice and the left edge of the specimen.

ILS NOTE 21: *For the ILS, we will not follow this procedure of multiple ignition trials on one specimen. If a specimen fails to ignite or "self extinguishes" after removal of the igniter, a fresh specimen must be used for the next trial.*

7. If the specimen self extinguishes and the specimen is re-useable, apply the third ignition equidistant between the center of the seat/back crevice and the right edge of the specimen.

8. Conduct a maximum of three ignition runs on a single seat/back, mock-up specimen of each upholstery fabric. If three ignition runs cannot be obtained with one test specimen, a second or third specimen may be required.
9. Terminate a test run if any of the following conditions occur:
   - The specimen self extinguishes.
   - Weight loss exceeds four percent of the initial specimen weight (Weight reaches 96% of initial weight).

ILS NOTE 22: *In place of the "four percent" criterion, we prefer to use a specific total mass loss of 60 g as one of the possible criteria to end the test. The other criteria (self extinguishment, 10 minutes total time, fire intensity and worker safety) are still valid.*

- Time of test exceeds ten minutes.
- Fire intensity and/or smoke evolution exceeds the capacity of the ventilation system and test must be aborted due to safety factors. Note: This is not an acceptable "end point" for the test, if one of the other criteria has not been exceeded. If an excessive smoke or fire condition occurs, test should be repeated in a hood exhaust system with adequate ventilation capacity to observe all failure criteria without compromising operator safety.

ILS NOTE 23: *If a specimen has lost at least 40 g, then termination of the test due to fire intensity or smoke evolution is acceptable. If less than 40 g was lost, a larger hood system may be required.*

- Any type of rapid increase in rate of combustion such that worker safety is compromised.

Note: When terminating a test, be certain that final weight readings are taken before extinguishing the specimen. Also, care should be taken that the weighing device and other instrumentation are not adversely affected by the process of extinguishing the specimen.

ILS NOTE 24: *A "final weight" is not necessary for this protocol, unless the specimen does not ignite or self extinguishes. Still, protection of the balance and other instrumentation is important in the choice of a procedure for extinguishing specimens.*

5.9 Pass/Fail Criteria

ILS NOTE 25: *We will have a number of specific "results," to be recorded (see separate document), but we will not have "pass/fail criteria."*

The sample must pass a minimum of three ignition runs.

The sample fails if any of the following criteria are exceeded during any ignition run:

- Weight loss exceeds four percent of the total initial weight of the specimen in the first 10 minutes of the test.
- The specimen burns progressively and it must be extinguished before 10 minutes.

5.10 Test Report

ILS NOTE 26: *For the ILS, the single-page results sheets (described in a separate document) will be our report.*

The test report shall contain, at a minimum, the following information:

- Name and address of the test laboratory.
- Date of the test(s).
- Operator conducting the test.
- Complete description of the test materials.
- Complete description of any procedures different from those described in this test method.
- Recorded results of the test as detailed below:

➢ Initial weight (pre-test weight)
➢ Weight corresponding to 96% of initial weight
➢ Time to reach a weight equal to 96 % of the initial weight.

The weight loss at any given time is calculated as follows:

% weight loss (WL) = (pre-test weight (A) - current weight (B))/ pre-test weight (A) x 100%. or
%WL = (A – B)/A x 100%

ILS NOTE 27: *We will specify the results to be reported for the ILS, to include times to specific mass loss values.*

Note: If direct observation of the time to reach four percent weight loss was not taken during the test, use a linear interpolation of the nearest test data points (preferably at five or six-second intervals, but no more than 15 second intervals) to calculate the time to four percent weight loss.

ILS NOTE 28: *A linear interpolation will be necessary to obtain the times corresponding to specific mass loss values.*

- Statement of overall Pass/Fail results.

(From TB 117 draft, Appendix B):
Observations of the test as detailed below may be valuable in assessing test results:

Observations shall be made, and included in the report, of the behavior of the specimen in response to the application of the burner, specifically noting the following:

- Time to apparent ignition of the specimen.
- Unusual burning characteristics, such as burning in an irregular pattern across the surface of either the seat or the back or burn through the specimen at any point.
- Extended smoldering (non-flaming) combustion.

ILS NOTE 29: *These observations are important, but they should be limited to recording and reporting unusual behavior.*

ANNEX A

Mock-up Test Apparatus

Butane Gas Flame Ignition Source

- The burner tube shall consist of a length of stainless steel tube, 8.0 ± 0.1 mm (5/16 ± 0.004 in) outside diameter, 6.5 ± 0.1 mm (0.256 ± 0.004 in) internal diameter and 200 ± 5 mm (8 ± 1/4 in) in length, connected to a cylinder containing butane.
- C.P. Grade butane, 99.0% purity with 2-stage regulator shall be provided.
- The following items are required to connect the butane cylinder to the burner tube: clear, flexible tubing (2.5 to 3.0 m (8 to 10 ft) in length, 7.0 ± 1.0 mm (1/4 ± 0.04 in) I.D.), a mass flow meter (optional), a fine adjustment needle valve, an on-off valve (optional) and a cylinder regulator capable of providing a nominal outlet pressure of 2.8 kPa (28 mbar).
- The flow rate of butane shall be 45 ± 2 ml/min (354 ± 16 cfm) at 23 °C (73 °F), which produces a flame height of approximately 35 mm (1 3/8 in) (measured from the center end of the burner tube when held horizontally and the flame allowed to burn freely in air).

ILS NOTE 30: *The pressure and flow specified should produce the flame length indicated. If not, check the components of the train for leaks and be certain the butane has been flowing for a long enough time to stabilize the flame and remove all air from the line.*

NOTE: The following specific items have been found to be satisfactory for the butane gas train: Air Products CP grade, 99.0% purity butane, 20 lb. cylinder; Matheson 2-stage regulator, Model 8-2-510; Matheson 9.0 kPa pressure gauge, P/N 63-3103; Matheson fine control valve, brass, Model 4170 series; Matheson mass flow meter, Model 8112-0422, 200 standard cubic centimeter (sccm) range (a mass flow meter has been found to be particularly useful for resetting the butane flow from day to day).

Furniture Metal Test Frame (Mock-up Frame)

The metal test frame shall consist of two rectangular metal frames (either aluminum, for lower weight, or steel is permissible), hinged together and capable of being locked at right angles to each other (as illustrated in Fig. 5 in BS 5852:1990). The frames shall be made of 25 mm x 25 mm (1 in x 1 in) steel or aluminum angle 3 mm (1/8 in) thick, and shall securely hold platforms of steel mesh set 6 ± 1 mm (0.25 ± 0.05 in) below the front face of each test frame. An optional standard edging section around the expanded metal will provide protection and greater rigidity. The hinge rod shall be continuous across the back of the rig. The frames shall be lockable at right angles.

ILS NOTE 31: *The frame is shown in Figure A-1 and need not be referenced back to BS 5852. An aluminum frame is much lighter than stainless steel and can be accommodated* *on a smaller balance. The aluminum frame is more likely than the SS frame to warp if test specimens are allowed to burn past the point indicated in the ILS protocol. It is advisable that more than one test frame be made available, so that one frame may be used while another is cooling down and/or being cleaned.*

Weighing Device

- A means of weighing the specimen and providing a display or electronic output of the weight is necessary. The device must be capable of accommodating the entire metal test frame with the specimen in place (typically, the total weight will be in the range of 13 to 15 kg) and must be capable of reading 1 ± 0.5 g.

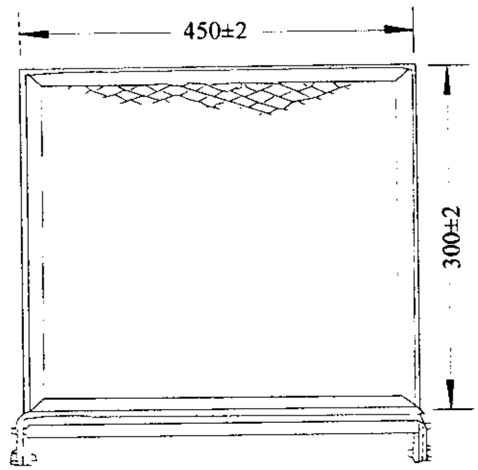
ILS NOTE 32: *It should not be necessary to have a balance with a 13-15 kg capacity. The weight of a steel frame test rig generally is around 4 kg, with an aluminum frame rig weighing less than 3 kg. Therefore, it will be possible to use a balance with a lower total capacity for the aluminum rig. There are several commercially-available balances with capacities of about 8 kg, which should be adequate for this protocol when using the aluminum frame test rig (or somewhat larger for a steel rig).*

- A means for recording the weight of the specimen at intervals equal to or less than every 15 s during the test shall be provided. Typically, a load (balance) cell with computer or chart recorder readout is used, with readings taken every 5 or 6 seconds. A test operator manually reading a clearly visible readout of the weighing device is adequate for this test procedure.

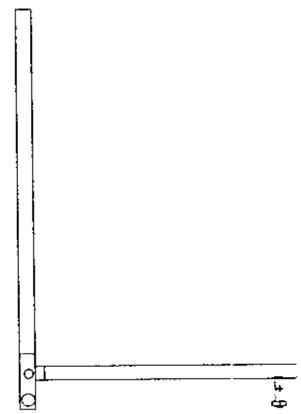
ILS NOTE 33: *In the additional information provided with the results sheets, a frequency of readings of no more than 10 seconds is specified.*

Instrumentation

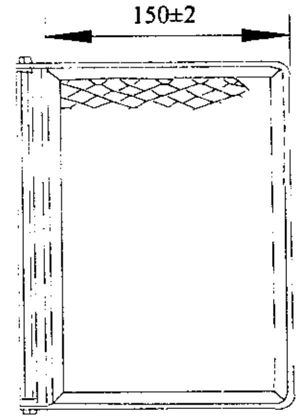
A stopwatch, accurate to 1 s and capable of measuring for at least one hour, shall be provided.



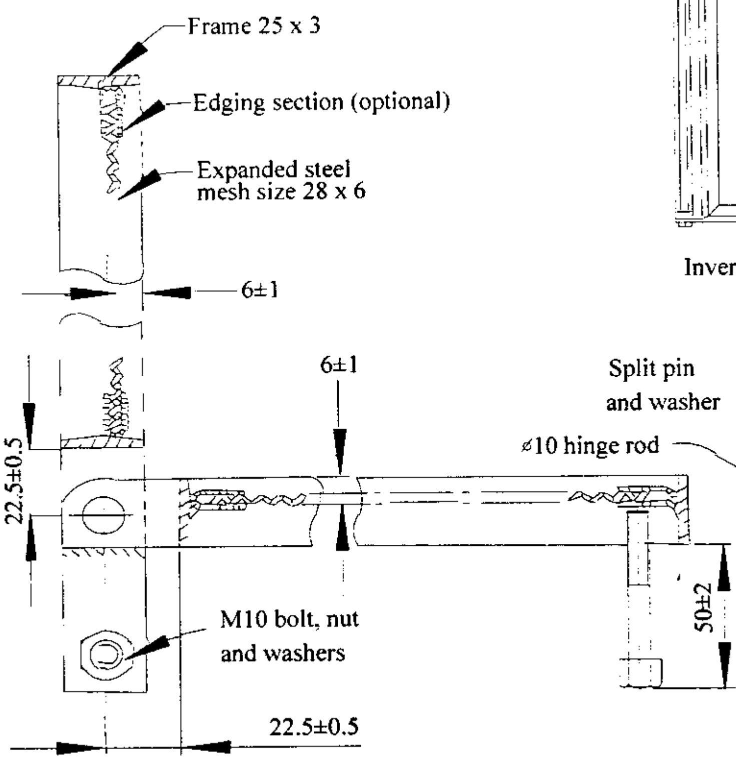
Front View

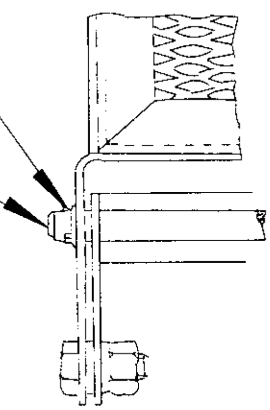


Side view



Inverted plan





View on arrow

Side section

All parts are of steel. All dimensions are in millimeters and have a tolerance of 2.5 %, unless otherwise shown.

FIGURE A-1. MOCK-UP TEST APPARATUS ASSEMBLY (METAL TEST FRAME)
ILS NOTE 34: *Some of the measurements on this drawing are not obvious. Please contact Kurt Reimann if further details are required. Stainless steel need not be used (see previous note regarding aluminum rigs).*

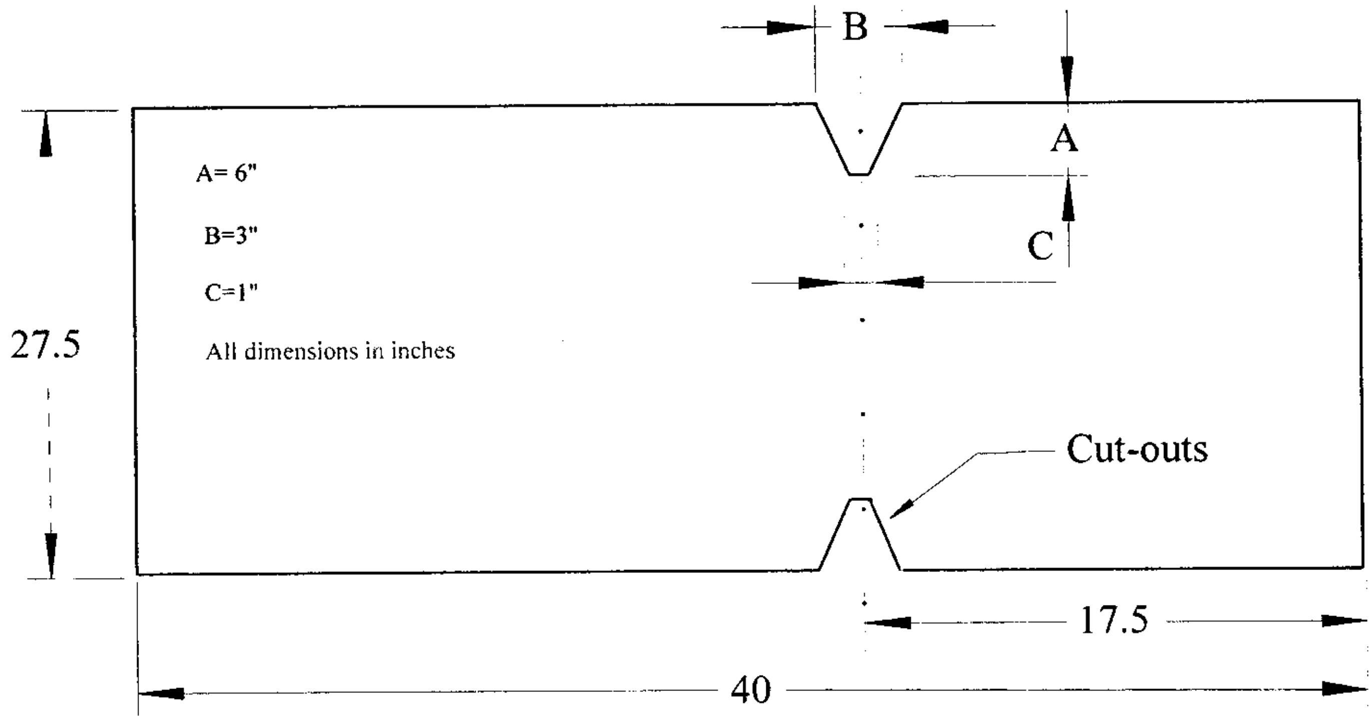


Figure A-2. Fabric cut-out for mock-up tests
ILS NOTE 35: *The dimensions on this drawing are incorrect. The correct ones are shown in the text (Section 5.7). Also, simple triangular cut-outs (rather than the truncated triangles shown) will be used for the ILS.*

ANNEX B

Test Facility, Exhaust System and Hazards

Test Facility/Exhaust System

- The test area shall be a room with a volume greater than 20 m^3 (in order to contain sufficient oxygen for testing) or a smaller area equipped with inlet and extraction systems permitting the necessary flow of air. Airflow rates shall be between 0.02 m/s and 0.2 m/s, measured in the locality of the test specimen position specimen to provide adequate air without disturbing the burning behavior.

Note: These rates of airflow have been shown to provide adequate oxygen without physically disturbing the burning behavior of the ignition source or the specimen.

- A means of extracting smoke and combustion gases from the test area shall be provided.

ILS NOTE 36: *These instructions need some clarification. The test procedure can be performed in a laboratory exhaust hood, provided that the following requirements are met: 1) airflow no greater than 0.2 m/s (40 ft./min.) measured at the juncture of the seat and back; 2) non-combustible lining on the inside of the hood (e.g., glass-reinforced cement board); and 3) a means for closing the hood door, or placing a shield, during extinguishments in order to prevent smoke from escaping the exhaust hood. The test rig can be set up on a bench or on the floor of a small room that has sufficient exhaust capability, as long as the airflow requirements can be met. Measurement of the flow must be performed with an instrument capable of accurately reading these low flow rates (e.g., a hot-wire anemometer), with a mock-up specimen in place. Measure air flow at three positions along the width of the specimen.*

Hazards

- There are potential risks associated with running any fire test. It is essential that suitable precautions be taken, which include the provision of breathing apparatus and protective clothing.
- Products of combustion can be irritating and dangerous to test personnel. Test personnel must avoid exposure to smoke and gases produced during testing.
- Suitable means of fire extinguishment shall be at hand. When the termination point of the experiment has been reached, the fire is extinguished, if necessary, with carbon

dioxide or water. Presence of a back-up fire extinguisher (water hose) is recommended.

- It may be difficult to judge when all combustion in a test specimen has ceased, even after extinguishment, due to potential burning deep inside the specimen. Care should be taken that specimens are disposed of only when completely inert.

ILS NOTE 37: *The size specimens required by this protocol and the end-point requirements make the use of water as an extinguishing agent unnecessary (water often is needed in dealing with combustion of full-size mock-ups). Also, water could have an adverse affect on instrumentation. Carbon dioxide extinguishers have been found to be adequate for these tests. A fresh, back-up extinguisher must be available.*

APPENDIX B
API ILS REPORT (JANUARY 2004)
COMPLETE $MLR_{20/40}$ AND T_{10} RESULTS

T1, T2, T3 refer to Test 1, 2 and 3 of the replicate tests; "sd" is standard deviation. The "Series" numbers refer to the compositions given in the body of the report

Average Mass Loss Rate over the range 20 – 40 g mass loss ($MLR_{20/40}$), g/s

Series 1

Lab	T1	T2	T3	Avg.	sd
1	0.870	0.769	0.769	0.803	0.058
2	0.833	0.800	0.833	0.822	0.019
3	0.894	0.867	0.878	0.880	0.014
4	0.909	0.833	0.800	0.847	0.056
5					
6	0.909	0.833	0.800	0.847	0.056
7	0.741	0.952	0.800	0.831	0.109
8	1.000	1.000	0.833	0.944	0.096
9	1.000	0.952	1.053	1.002	0.050
10	0.699	0.772	0.784	0.752	0.046
11	0.833	1.000	0.909	0.914	0.083
12	0.769	0.909	0.833	0.837	0.070

Series 2

Lab	T1	T2	T3	Avg.	sd
1	0.408	1.111	0.948	0.822	0.368
2	1.000	0.909	0.909	0.939	0.052
3	0.975	1.037	0.959	0.991	0.041
4	1.111	1.053	1.053	1.072	0.034
5	0.833	0.870		0.851	0.026
6	1.000	0.909	0.952	0.954	0.045
7	1.000	0.952	1.053	1.002	0.050
8	0.952	0.952	1.000	0.968	0.027
9	0.870	0.909	1.000	0.926	0.067
10	0.939	0.873	0.913	0.909	0.033
11	0.426	0.408	0.417	0.417	0.009
12	0.909	0.909	0.952	0.924	0.025

Series 3

Lab	T1	T2	T3	Avg.	sd
1	0.741	0.625	0.800	0.722	0.089
2	0.400	0.444	0.465	0.437	0.033
3	0.270	0.292	0.341	0.301	0.036
4	0.476	0.526	0.541	0.514	0.034
5	1.000	1.000	1.111	1.037	0.064
6	0.308	0.282	0.526	0.372	0.134
7	0.526	0.833	0.800	0.720	0.168
8	0.400	0.339	0.667	0.469	0.174
9	0.392	0.260	0.286	0.313	0.070
10	0.658	0.571	0.552	0.594	0.056
11	0.392	0.606		0.499	0.151
12	0.317	0.303	0.278	0.299	0.020

Series 4

Lab	T1	T2	T3	Avg.	sd
1	0.198	0.169	0.165	0.178	0.018
2	0.142	0.130	0.120	0.131	0.011
3	0.133	0.142	0.139	0.138	0.004
4	0.202	0.169	0.198	0.190	0.018
5	0.141	0.132	0.139	0.137	0.005
6	0.119	0.119	0.125	0.121	0.003
7	0.183	0.174	0.194	0.184	0.010
8	0.164	0.149	0.168	0.160	0.010
9	0.133	0.137	0.116	0.129	0.011
10	0.152	0.157	0.156	0.155	0.003
11	0.215	0.217	0.213	0.215	0.002
12	0.134	0.140	0.133	0.136	0.004

Series 5

Lab	T1	T2	T3	Avg.	sd
1	0.741	0.667	0.645	0.684	0.050
2	0.714	0.690	0.645	0.683	0.035
3	0.754	0.771	0.791	0.772	0.019
4	0.741	0.714	0.833	0.763	0.063
5	0.556	0.714	0.870	0.713	0.157
6	0.513	0.625	0.435	0.524	0.096
7	0.800	0.645	0.667	0.704	0.084
8	0.625	0.800	0.571	0.665	0.120
9	0.667	0.690	0.690	0.682	0.013
10	0.769	0.976	0.810	0.852	0.109

Series 5 (continued)					
11	0.294	0.303	0.303	0.300	0.005
12	-0.087	0.625	0.645	0.395	0.417

Series 7

Lab	T1	T2	T3	Avg.	sd
1	0.396	0.556	0.526	0.493	0.085
2	0.435	0.526	0.476	0.479	0.046
3	0.452	0.473	0.374	0.433	0.052
4	0.526	0.606	0.556	0.563	0.040
5	0.426	0.513	0.500	0.479	0.047
6	0.392	0.385	0.370	0.382	0.011
7	0.455	0.408	0.488	0.450	0.040
8	0.392	0.500	0.455	0.449	0.054
9	0.500	0.426	0.488	0.471	0.040
10		0.412		0.412	
11	0.286	0.290	0.290	0.288	0.002
12	0.351	0.392	0.351	0.365	0.024

Time to 10 g mass loss (t_{10}), s

Series 1

Lab	T1	T2	T3	Avg.	sd
1	86	82	84	84.0	2.0
2	89	88	86	87.7	1.5
3	80	81	79	80.1	1.1
4	73	75	75	74.3	1.2
5	84	89		86.5	3.5
6	87	95	84	88.7	5.7
7	90	71	78	79.7	9.6
8	68	75	80	74.3	6.0
9	82	81	78	80.3	2.1
10	47	59	66	57.2	9.9
11	89	83	85	85.7	3.1
12	104	92	111	102.3	9.6

Series 2

Lab	T1	T2	T3	Avg.	sd
1	28	48	67	47.3	19.3
2	64	64	64	64.0	0.0
3	62	60	60	60.4	1.1
4	59	54	59	57.3	2.9
5	59	61	56	58.7	2.5
6	64	59	53	58.7	5.5
7	48	62	58	56.0	7.2
8	57	61	58	58.7	2.1
9	62	63	63	62.7	0.6
10	45	44	44	44.5	0.8
11	100	99	99	99.3	0.6
12	71	68	65	68.0	3.0

Series 3

Lab	T1	T2	T3	Avg.	sd
1	103	96	102	100.3	3.8
2	103	102	99	101.3	2.1
3	100	101	104	101.9	2.3
4	101	96	91	96.0	5.0
5	59	65	60	61.3	3.2
6	90	98	100	96.0	5.3
7	103	84	93	93.3	9.5
8	104	90	89	94.3	8.4
9	105	98	103	102.0	3.6
10	89	79	76	81.2	7.0
11	86	99		92.5	9.2
12	111	114	113	112.7	1.5

Series 4

Lab	T1	T2	T3	Avg.	sd
1	125	116	107	116.1	9.0
2	116	121	120	119.0	2.6
3	123	124	122	122.9	1.2
4	98	109	103	103.3	5.5
5	111	113	106	110.0	3.6
6	115	108	103	108.7	6.0
7	112	110	105	109.0	3.6
8	116	112	113	113.7	2.1
9	109	108	113	110.0	2.6
10	115	102	108	108.4	6.5

Series 4 (continued)					
11	114	113	115	114.0	1.0
12	124	124	137	128.3	7.5

Series 5

Lab	T1	T2	T3	Avg.	sd
1	99	102	102	101.0	1.7
2	118	108	127	117.7	9.5
3	107	105	99	103.8	4.2
4	73	78	76	75.7	2.5
5	120	106	135	120.3	14.5
6	105	137	110	117.3	17.2
7	100	105	94	99.7	5.5
8	93	94	90	92.3	2.1
9	103	120	105	109.3	9.3
10	71	70	60	66.8	5.7
11	117	116	115	116.0	1.0
12	202	124	124	124.0	0.0

Series 7

Lab	T1	T2	T3	Avg.	sd
1	118	139	130	128.8	10.5
2	129	125	135	129.7	5.0
3	140	140	138	139.3	1.2
4	127	118	125	123.3	4.7
5	136	122	127	128.3	7.1
6	120	128	123	123.7	4.0
7	124	124	132	126.7	4.6
8	135	124	116	125.0	9.5
9	147	147	154	149.3	4.0
10		122	131	126.3	6.0
11	152	150	149	150.3	1.5
12	153	150	149	150.7	2.1

APPENDIX C
API ILS REPORT (JANUARY 2004)
HRR PLOTS OF LARGE SCALE AND FULL SCALE TESTS

INTRODUCTION

The plots below are representations of the heat release rate (HRR) curves for the various tests conducted on "large scale" (LS) specimens and "full scale" (FS) specimens. The LS specimens consisted of California TB 133-size cushions in that test's mock-up frame. The FS specimens were full-size chairs. In particular, the chairs were built in the form of "recliner chairs." The ignition source for these tests was identical to that used in the ILS, the "source 1" igniter from BS 5852.

The "Series" designations used in these plots refer to the compositions in Table 2 of the main report. For sake of convenience, the compositions represented in the LS and FS tests are repeated below (for details on the components, please see Table 2 with its footnotes).

Table C-1. Combinations of Components Used in the Large Scale and Full Scale Tests

Series	Fabric	Foam	Batting	Interliner
2	"Selected" fabric	New Cal. 117	Conventional	none
3	"Selected" fabric	New Cal. 117	New Cal 117	none
4	"Selected" fabric	New Cal. 117	Conventional	Commercial FR
7	Heavy polyolefin	New Cal. 117	Conventional	Commercial FR

The L1, L2, F1 and F2 designations in the figures refer to Labs 1 and 2 conducting the FS experiments, and to Labs 1 and 2 conducting the LS experiments, respectively. The identification of those laboratories is not important to the results and analysis as presented in this report. Note that the scales for the y-axes (HRR in kW) and x-axes (Time in s) are not the same for all plots; however, they are the same for comparable plots (e.g., the two plots for Labs L1 and L2 for LS Series 2 contain the same scales).

DISCUSSION

No statistical analysis of the results of the LS and FS tests, in contrast to the treatment of the ILS results, was attempted. The reasons for this are as follows:

1) Only two laboratories were represented for the LS tests and only one laboratory for most of the FS tests.
2) While each lab replicated the test three times, opening the possibility for statistical analysis, a "test result" for these experiments has not been established. The protocol was to follow the same ignition scenario as was conducted on the laboratory-size specimens (i.e., for the ILS), but on a larger scale specimen. Thus, it is unclear whether the test result for these experiments should be a function of mass loss (e.g., time to mass loss or mass loss rate over some period), or of heat release rate (e.g., average HRR over some period, peak HRR or other measure). Since the LS experiments were continued to "completion" of the burning (i.e., including a peak HRR), but most of the FS experiments were not, selection of any particular HRR measurement that would be applicable to all tests seemed unreasonable.
3) The purpose of the LS and FS tests was to evaluate the fire performance of the larger-scale specimens in comparison to the laboratory-scale results. This "evaluation" was not intended to be based on statistical analyses.
4) The mass loss results for the large- and full-scale experiments were not as consistent as those for the small-scale (SS) tests. This was due to several causes. First, the size of the specimens in the FS tests required one laboratory (L1) to use a different load cell for those tests than for their LS tests. Second, the "open" nature of the test facilities for the LS and FS tests in either laboratory probably allowed more drafts around the specimen than for the SS tests. The LS and FS tests were conducted in high-bay areas where the more substantial burning of the specimens would neither damage the facilities nor create a hazard for the operators. In addition, the specimens were located directly under a large exhaust hood (e.g., 10 ft. square for at least one of the facilities) which was capable of withdrawing all of the smoke produced by the burning specimens. While the hood itself is not intended to create any drafts, the presence of the hood over a specimen in a large open area constitutes a much different environment for precise mass measurements than a laboratory-scale specimen enclosed within a laboratory exhaust hood. Finally, the larger size of the LS and FS specimens necessarily creates a larger fire that, in turn, causes more convective flow of air around the specimen.
5) The purpose of the LS and FS experiments, in contrast to the ILS tests, was more from a research and development point of view. They were not conducted with the purpose of developing statistical analysis.

The plots on the following pages include the following:

1) Two plots each for LS "Series 2," "Series 3," and "Series 7" experiments (one each for labs L1 and L2). The "Series 4" experiments for lab L1 did not produce any HRR results, so the "results" were not plotted.

2) The most representative single plot for each lab and each series was selected for a "comparison" plot (there are three, for Series 2, 3 and 7).
3) Selected LS experiments, consisting of one curve from each of the four series from lab L1, are presented as a typical series of LS HRR plots.
4) For the FS experiments, Series 3 is represented by two sets of plots (labs F1 and F2); while tests of the Series 2, 4 and 7 specimens were conducted in only one lab (F1). In addition, a plot of F1-3a is shown as the only F1 experiment (i.e., full scale) that was not extinguished.
5) Selected FS experiments, consisting of one curve from each of the four series from lab F1, are presented as a typical series of FS HRR plots.

Large Scale

The "repeatability" of large scale fire tests has been a topic of considerable discussion. Often, the pattern of the HRR-time curve in comparable tests is similar, but the peak HRR is not. For this reason, sometimes a "running average" HRR is calculated (similar to a smoothing routine), rather than the individual, measured HRRs. Sometimes, the peak HRR values for comparable tests are close, but the times to reach those peaks are very different. Sometimes, in comparable tests, one HRR-time curve will have a single peak HRR and the other will have two "peaks" that are often lower than the single peak HRR. In those cases, an average HRR over some time period (or the total HRR for the experiment) could be better for comparison than the peak. In addition, the time to start of an increase in HRR (i.e., either time to ignition or to some fixed, low value of HRR) is an important characteristic of HRR-time curves for comparison purposes.

The first set of curves in the LS set are for "L1 Series 2" and "L2 Series 2," i.e. the results of testing the same "Series 2" cushions in the two laboratories. In each case, there are differences in the HRR-time curves within each lab and differences between the two labs. For lab L1, tests 2b and 2c were nearly identical, but rather different from 2a both in shape and in peak HRR (the former two being around 450 kW and the latter about 350 kW). However, all three tests seem to "start" within a similar time frame (i.e., around 100 – 150 s). For Lab L2, the three curves seem to be very different from one another. In fact, curves 2b and 2c are different mostly because the time in 2b is delayed by 100 or more seconds compared to 2c (the reason for this is unknown). The curve for 2a has a different shape than either of the other two, but the peak HRR is very similar to 2b (about 300 kW), while substantially lower than 2a (with a peak just over 400 kW). A direct comparison of a "typical" curve from lab L1 vs. lab L2 will be shown later. It is apparent that curves L1-2b and 2c are rather similar to L2-2c, but that there is some substantial variability among the replicate tests.

In the Series 3 LS tests, "L1 Series 3" and "L2 Series 3," there is less agreement within each lab than was demonstrated with the Series 2 specimens. This may be due to the presence of batting in the Series 3 tests. In all cases, multiple "peaks" in the HRR curves are present (something that cannot be accommodated by reporting "the peak HRR" in a summary table). In any event, the HRR for the peaks is around 100 – 200 kW for both sets of results and, in nearly all cases, the HRR curves begin to increase around 200 s (Test L2-3c began to increase much earlier than the others; while one of the L2 specimens in Series 2 was delayed compared to the others – for no apparent reason).

In the tests on Series 4 specimens, none of the L1 tests produced any measurable HRR, so no "curves" are shown. In the L2 tests, only minimal HRR was detected (less than 20 kW, which is less than the ignition burner output in the Cal TB 133 test protocol). For all practical purposes, the L1 and L2 tests on Series 4 produced the same result.

Results of the Series 7 specimens are shown in the graphs labeled "L1 Series 7" and "L2 Series 7." Replication of the results, both within a lab and between labs, does not appear to be very good for these tests. In every case, either the peak HRR or the time to that peak is rather different from other, replicate tests. Within lab L1, the "peak" HRR values were between 150 and 200 kW and the times to peaks ranged from about 700 to 1000 s (i.e., just under 12 min. to more than 16 min.). All tests seemed to start evolving heat at about the same time (somewhat under 200 s, about 3 min.). The L2 tests were somewhat more variable, with the range of peak HRR values from less than 100 kW (although this test, L2-7c, seems as though it has been extinguished before the others) to more than 200 kW, with times to the "peaks" ranging from about 700 to 850 s). The HRR curves for L2 have some irregularity in the early stages, with more significant HRR showing up after about 250-300 s. Thus, while these curves are much less "regular" than some HRR curves, the results all fall within a range that can be dealt with.

The next three figures in this series contain one selected curve from each lab (generally, the "middle" curve from the set of three) for purposes of direct comparison of the results of two labs. In "Compare L1 & L2 – Series 2," the peak HRR for L1-2a is substantially higher than for L2-2a (about 450 kW compared to less than 300 kW) and the times to these peaks are somewhat different (about 275 vs. about 300 s, respectively). The onset of significant HRR, however, seems very similar at about 150 s.

In the comparison figure for Series 3, the irregularity of the HRR-time curves is apparent. However, it is also apparent that the average HRR over the range of 200 to 600 s for the two tests might not be too different. In the real world, the difference between about 150 and 200 kW as a peak HRR is not large.

Despite the irregularity of the Series 7 HRR curves, the two "typical" curves shown in the comparison figure ("Compare L1 & L2 – Series 7") are very comparable. The curve for lab L2 seems displaced in time by about 100 s, but otherwise has a very similar pattern of HRR vs. time. The apparent peak HRR values for the two curves are almost identical.

The last figure in the series is titled "Selected Large Scale Tests-L1" and contains four plots (all from Lab L1, for consistency) to illustrate the comparison among the four composite formulations. While substantial differences have been observed for the LS tests within and between labs, these "selected" HRR curves reasonably represent all of the previous plots with respect to a comparison of peak HRR and time to major involvement of the specimen. It is apparent from this plot of "selected" curves, that the Series 2 specimens had a higher HRR at an earlier time than any of the others and that the Series 4 specimens produced little or no HRR. The results for Series 3 and 7 specimens are "intermediate" in that neither one produced an excessive amount of energy (i.e., as measured by HRR) and that both caused combustion to be delayed from the pattern displayed by the Series 2 specimen.

Full Scale

The full scale (FS) tests were conducted in the same manner as the LS tests, except with a full-size piece of furniture. The components were the same as for the LS (and ILS) specimen, but configured as would be done for a commercial item. The ignition source was the same as for the LS and ILS tests. The igniter had to be somewhat "reconfigured" because of the presence of the arms (the igniter was bent in order to be applied from the front of the chair and still have a portion of the igniter tube parallel to the junction of the seat and the back).

Most of the full scale tests were extinguished after the fire appeared to be "taking off" and heading in the direction of 1000 kW (i.e., 1 MW, which is generally associated with "flashover" in a standard size test room). Therefore, the plots are shown only up to 1000 kW or less. The exceptions to this are the three "Series 3" tests by lab F2 (the only tests conducted by F2), which were continued to the approximate end of flaming combustion, and L1-3a, which was also continued to the end of flaming. Test L1-3a was conducted inside a test room, whereas all of the other tests were conducted in the open, directly under the exhaust/measurement hood.

The plots in "Full Scale HRR – F1 Series 2" represent the HRR-time pattern for the replicate tests conducted on full size Series 2 specimens. While there are some differences at the very low end of the HRR scale, these specimens generally appear to be nearly identical in their pattern of HRR vs. time.

The "Series 3" tests for Lab F1 have somewhat more variability with respect to time than the Series 2. Tests 3b and 3c were terminated after only about 400 kW, but it was apparent by that time in the test that they would have continued to more than 1000 kW, as was the case for Test 3a.

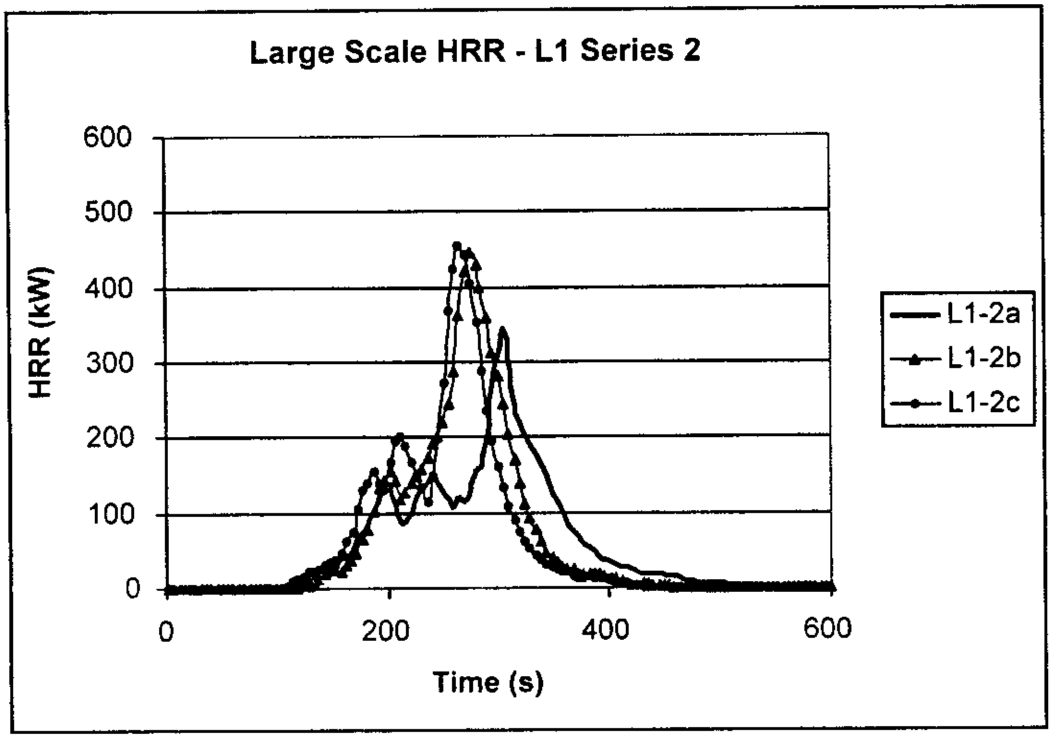
Test F1-3a was permitted to burn. In that respect it may be compared to the results of the Series 3 tests by lab F2 (shown in the figure "Full Scale HRR F2 Series 3"). However, the F1-3a experiment was conducted in a test room, rather than in an "open calorimeter" as was the case for the F2 experiments (and all of the other F1 experiments). It has been shown that the heat feedback from the walls of a test room accelerates the burning and produces an artificially high HRR compared to results in the open. Therefore, the peak

HRR for F1-3a of 2000 kW, compared to about 1200-1400 kW for the F2-Series 3 experiments might not be too surprising. The times at which HRR for all of the Series 3 tests started to increase were very similar (all near 200 s) and the times to peak HRR values were all around 300-350 s. The repeatability of the three tests for lab F2 appeared to be no worse than for the large scale tests.

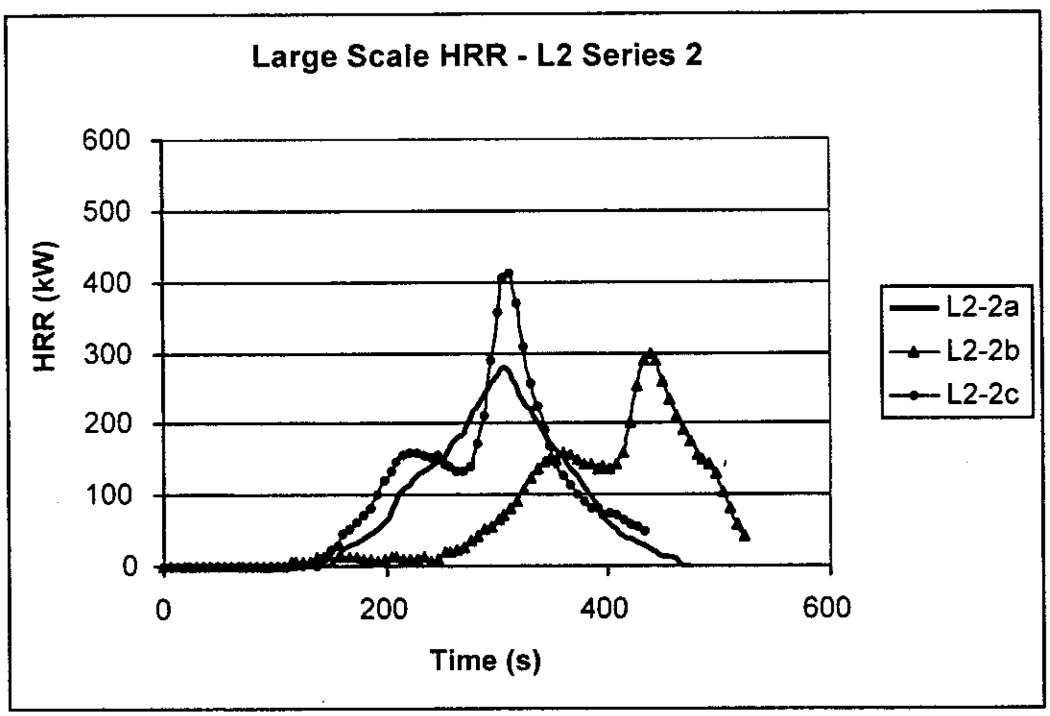
The results for the "Series 4" FS specimens were surprising. Whereas the ILS Series 4 specimens burned very slowly and the LS Series 4 specimens barely burned at all, the full size specimens eventually burned up, after a long period of low-level burning. It is uncertain at this time why these specimens eventually "failed," but it is likely that the integrity of the interliner (FR barrier fabric) was not as good throughout the chair as it had been for the laboratory specimens and the LS cushions. Possibly, there was a breach in the interliner where the arms met the seat or other location that permitted fire to break through into the foam. In any event, the breakthrough and higher HRR (e.g., 200 kW) did not occur until greater than 900 s (15 min.) following application of the igniter. This is a substantial "safety factor," in terms of escape time, compared to the other configurations.

The "Series 7" tests were also terminated after about 400 kW (at that point, a trained operator can tell that the HRR will continue to build, that there is essentially not chance that the item is going to self-extinguish or slow its burning rate anytime soon). While there are some differences in the times at which the specimens began burning, the slope of the HRR-time curves are very similar. The range in times at which the HRR began to increase was approximately 200-250 s.

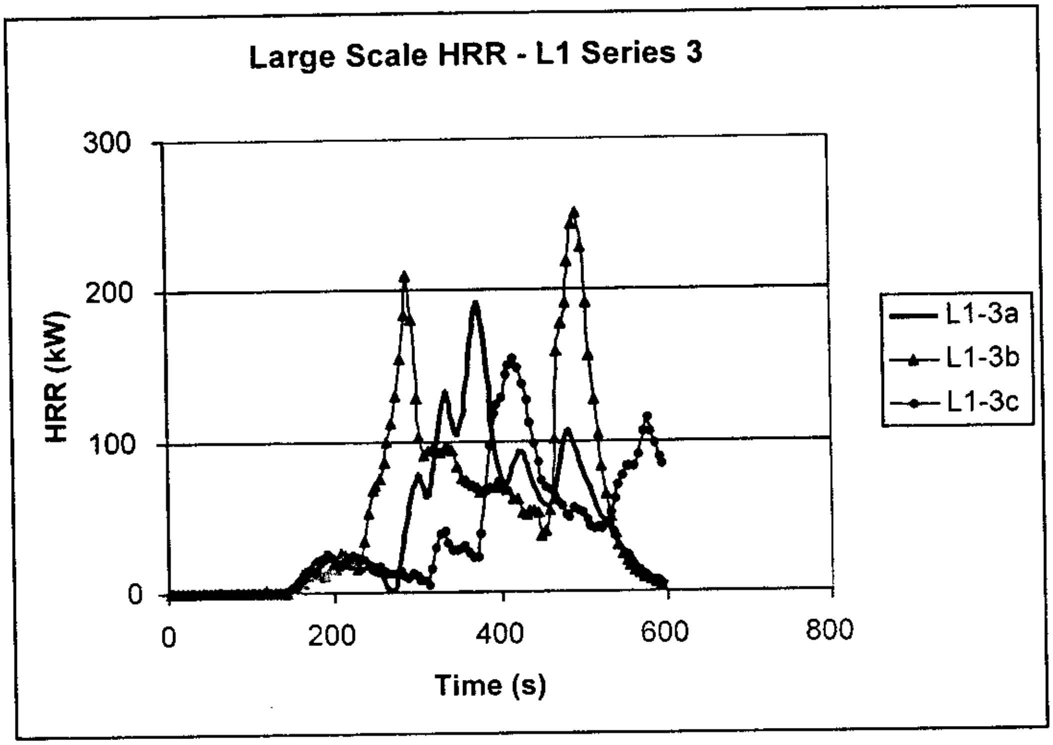
"Selected" full scale tests from lab F1 for the four composites specimens are shown in a single figure. It is apparent that there is a substantial and significant difference between the results for any of the Series 2, 3 and 7 tests compared to Series 4, the latter producing HRR much later in time. The differences among the Series 2, 3 and 4 specimens are debatable. Series 2 seems to be the "worst case" of the three, but the range of results discussed above make it unclear whether or not there is a significant difference between the results of the Series 3 and Series 7 full scale tests.

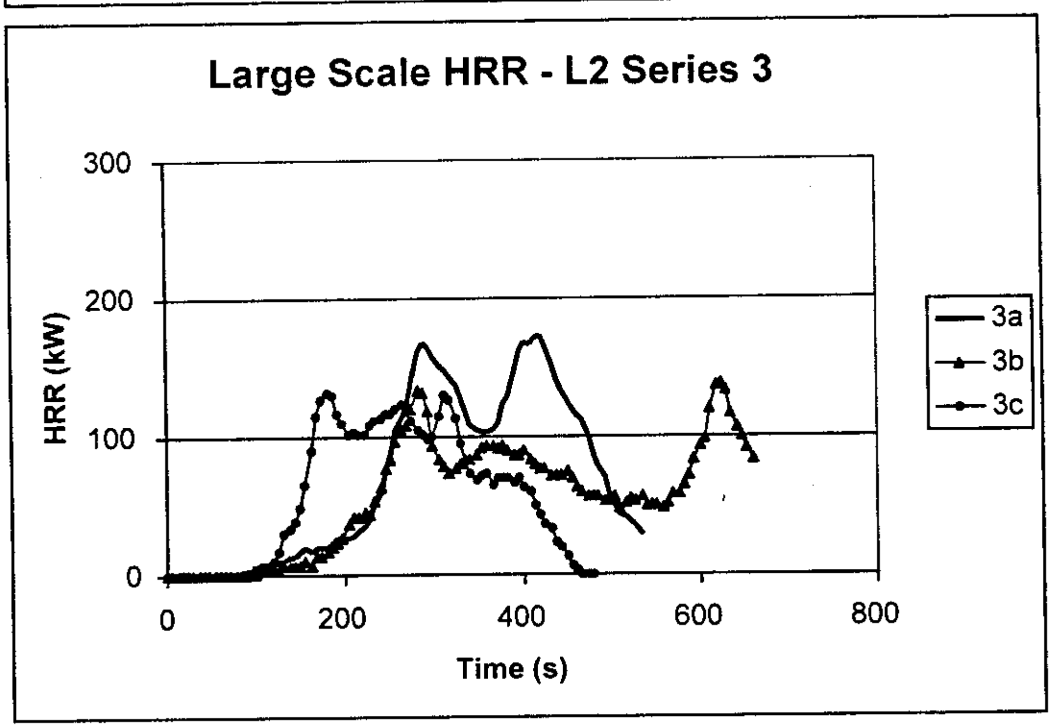


Large Scale HRR - L1 Series 2
HRR (kW)
600
500
400
300
200
100
0
0
200
400
600
Time (s)
L1-2a
L1-2b
L1-2c

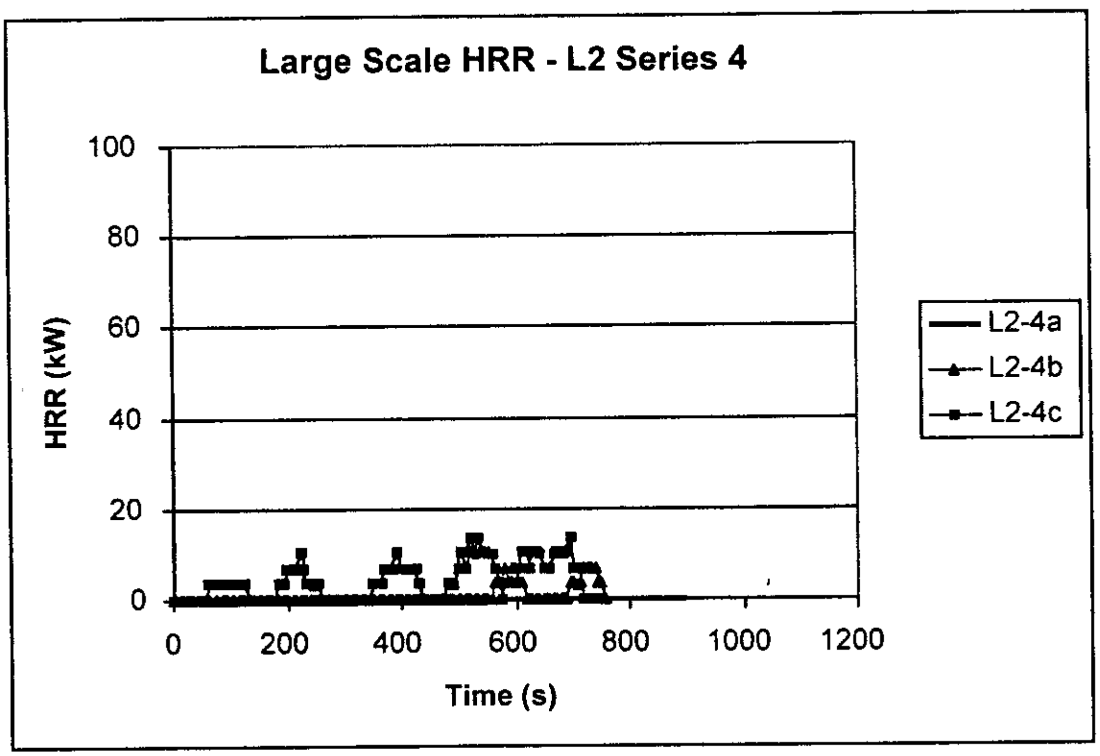


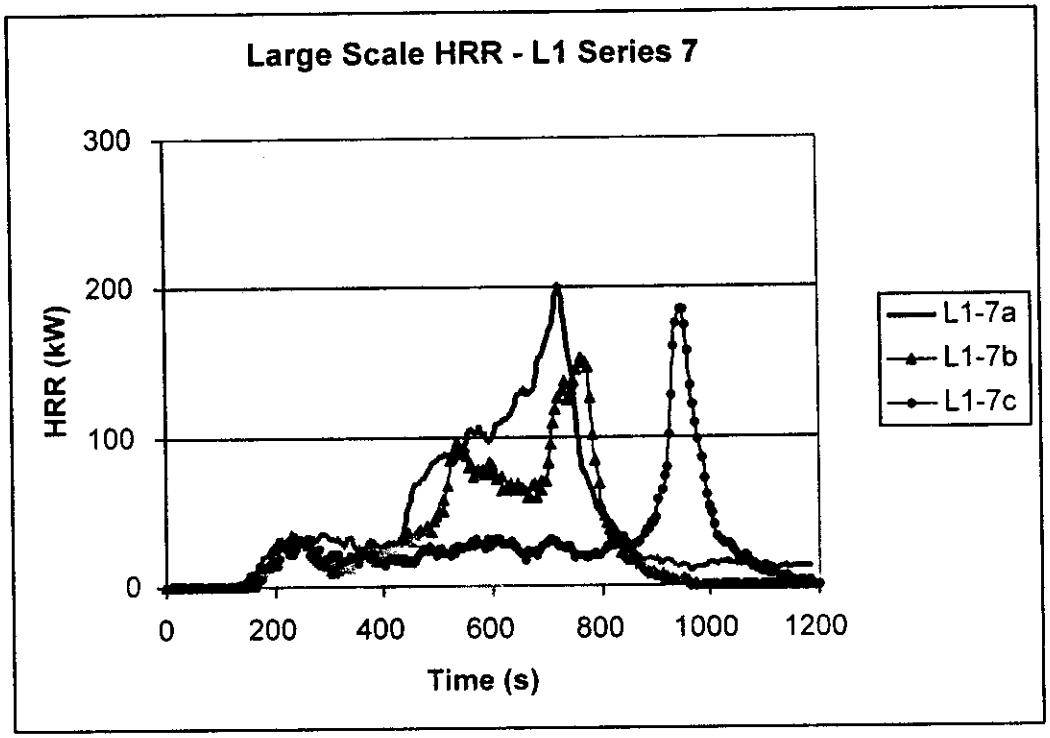
Large Scale HRR - L2 Series 2
HRR (kW)
600
500
400
300
200
100
0
0
200
400
600
Time (s)
L2-2a
L2-2b
L2-2c

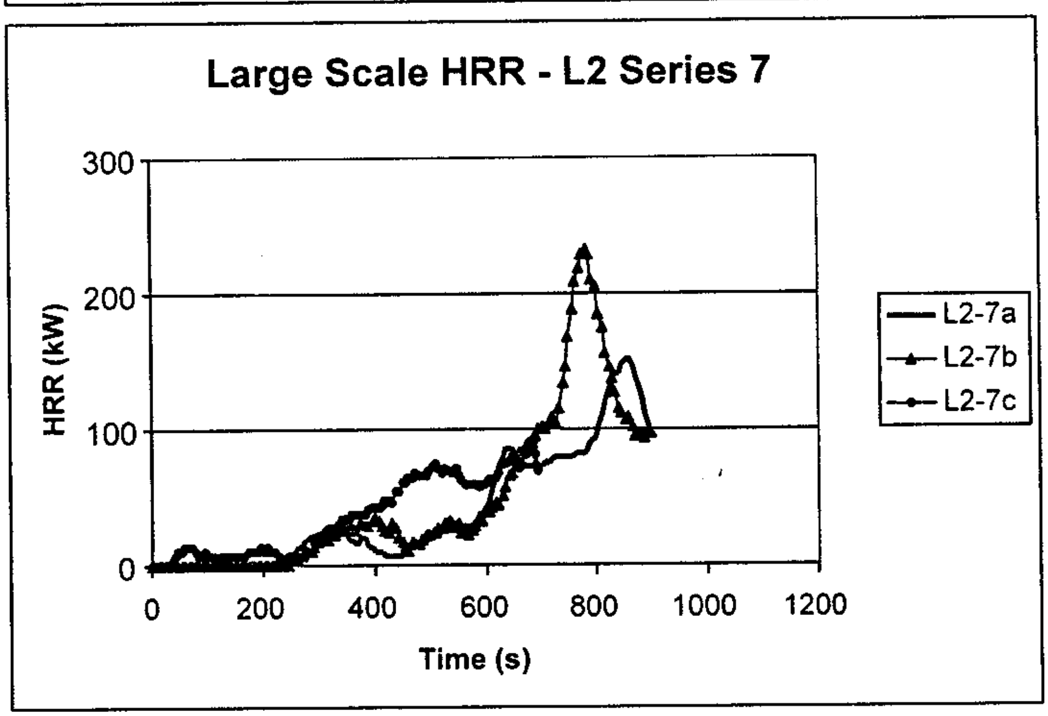

Large Scale HRR - L1 Series 3
HRR (kW)
300
200
100
0
0
200
400
600
800
Time (s)
L1-3a
L1-3b
L1-3c

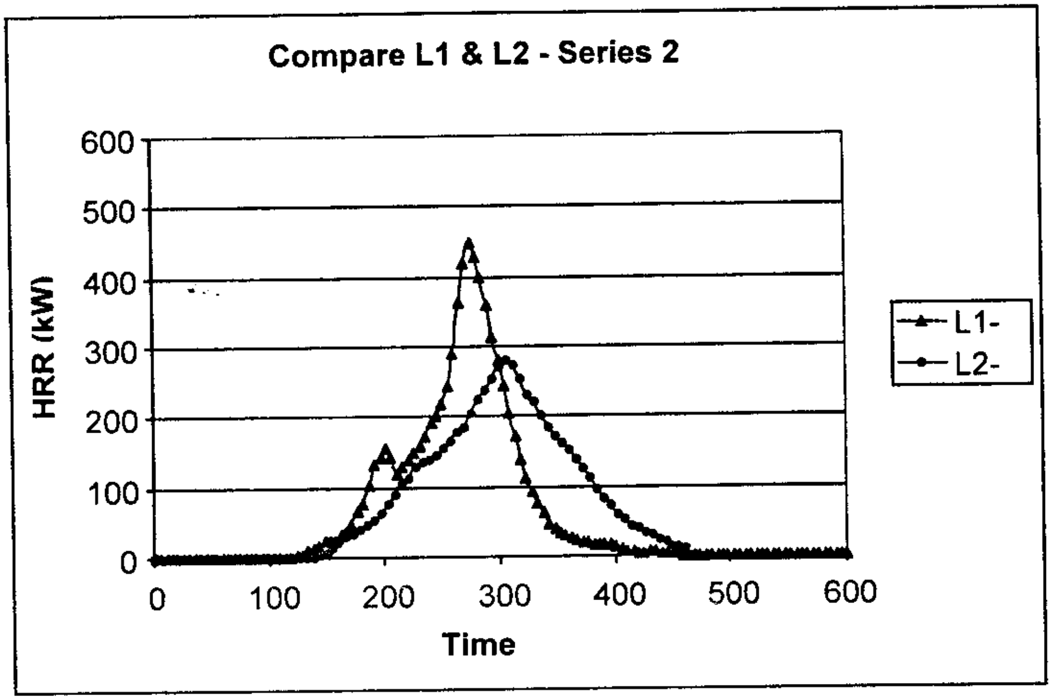

Large Scale HRR - L2 Series 3
HRR (kW)
300
200
100
0
0
200
400
600
800
Time (s)
3a
3b
3c

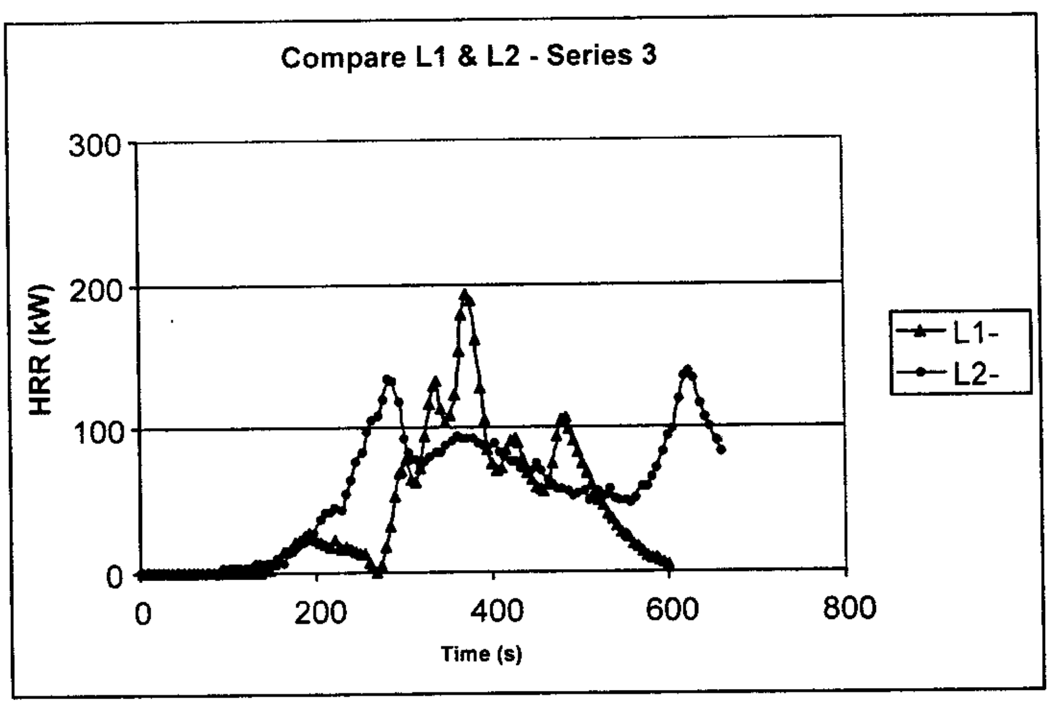
LARGE SCALE HRR – L1 SERIES 4:
NO IGNITION, NO HRR ANY TESTS

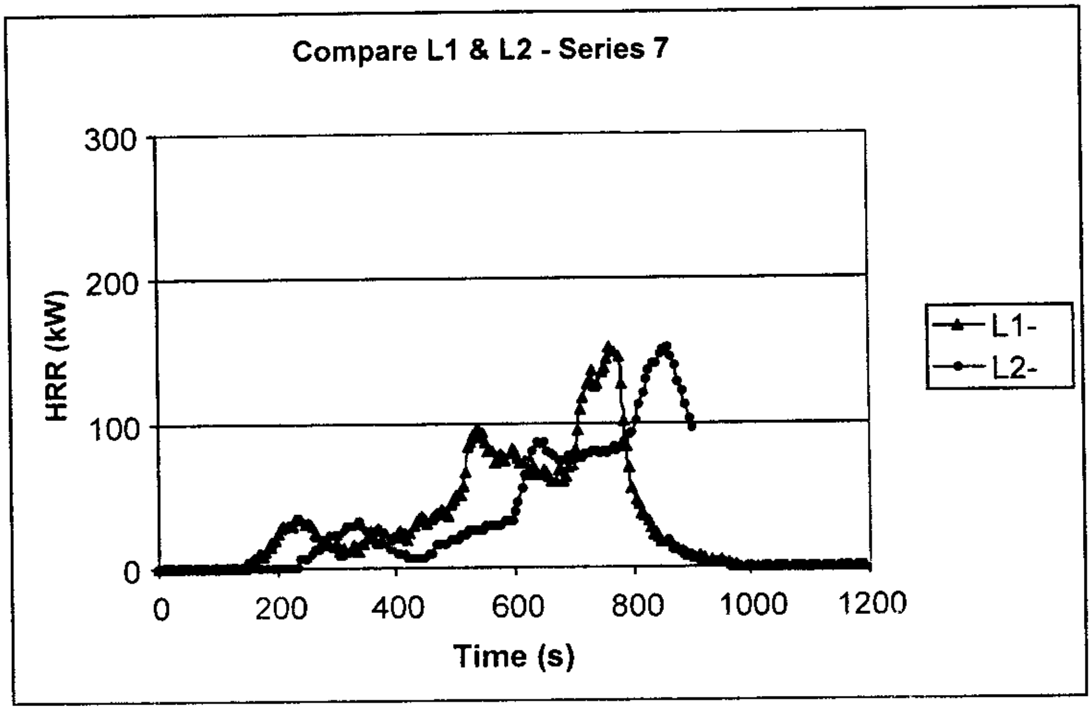



Large Scale HRR - L1 Series 7
HRR (kW)
300
200
100
0
0
200
400
600
800
1000
1200
Time (s)
L1-7a
L1-7b
L1-7c

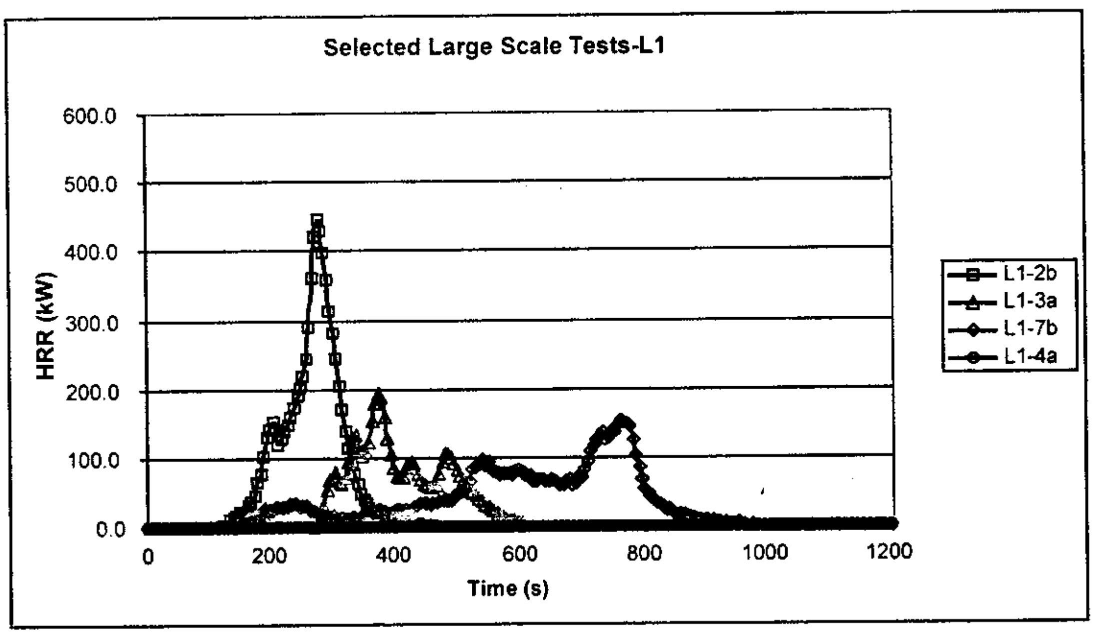

Large Scale HRR - L2 Series 7
HRR (kW)
300
200
100
0
0
200
400
600
800
1000
1200
Time (s)
L2-7a
L2-7b
L2-7c


Compare L1 & L2 - Series 2
HRR (kW)
600
500
400
300
200
100
0
0
100
200
300
400
500
600
Time
L1-
L2-

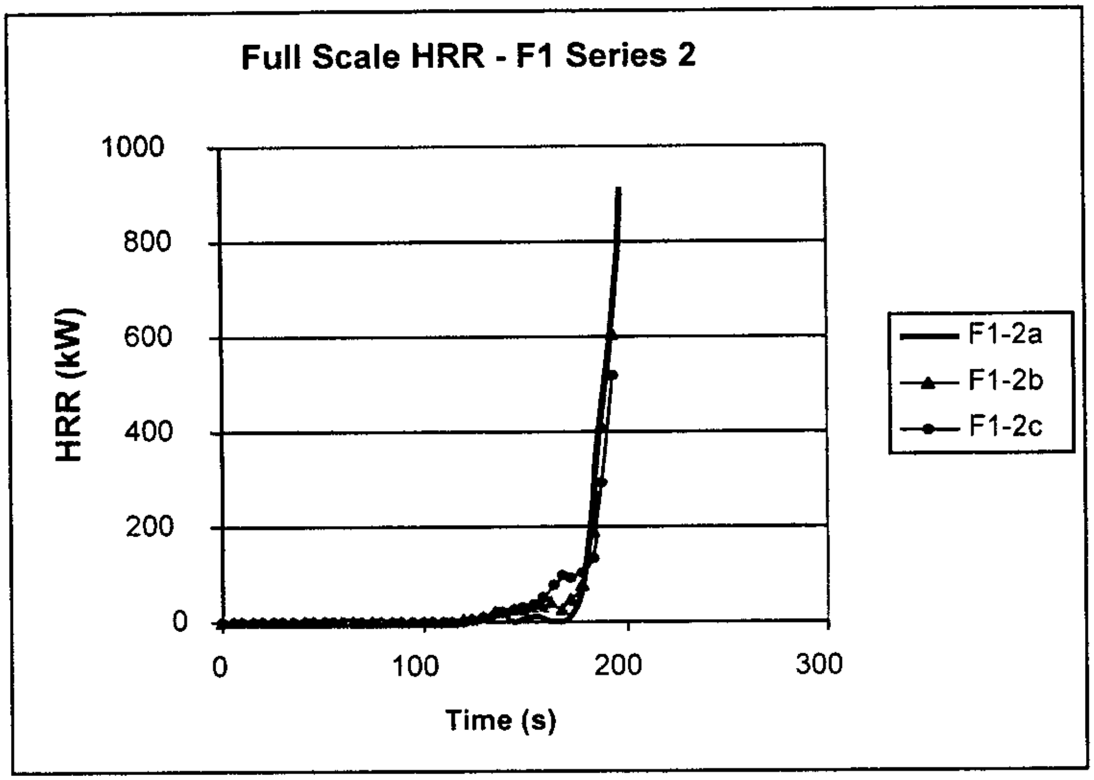

Compare L1 & L2 - Series 3
HRR (kW)
300
200
100
0
0
200
400
600
800
Time (s)
L1-
L2-

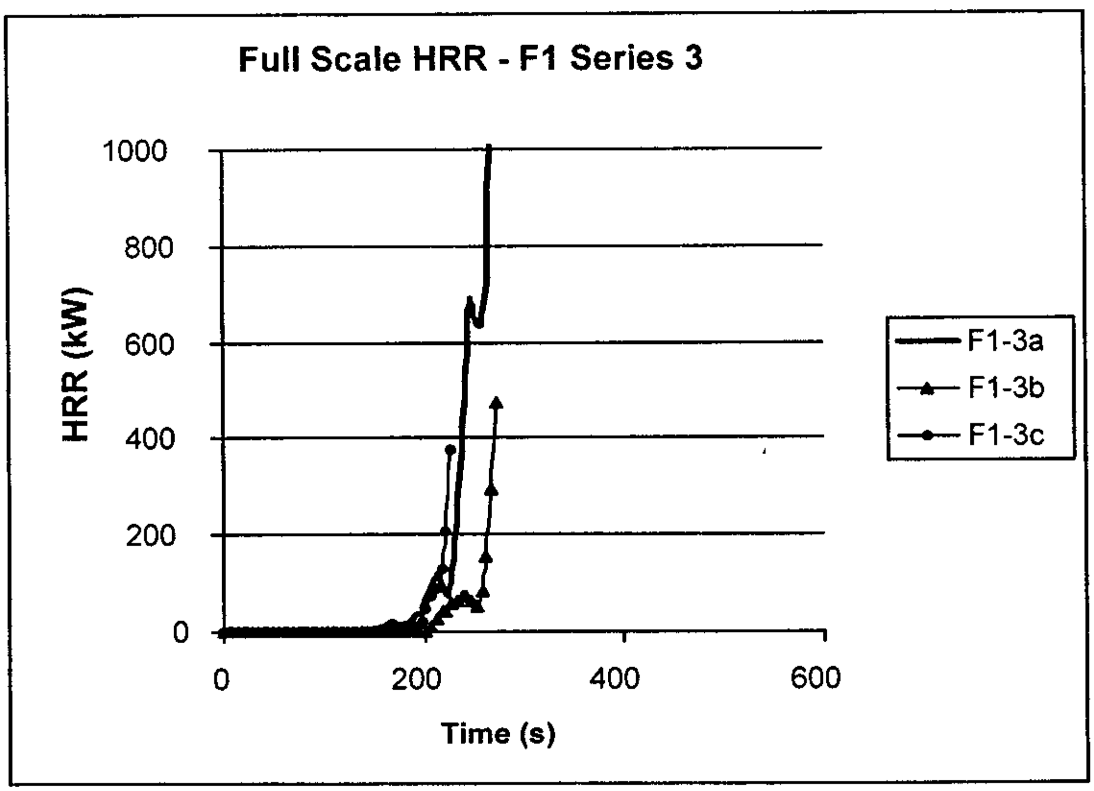


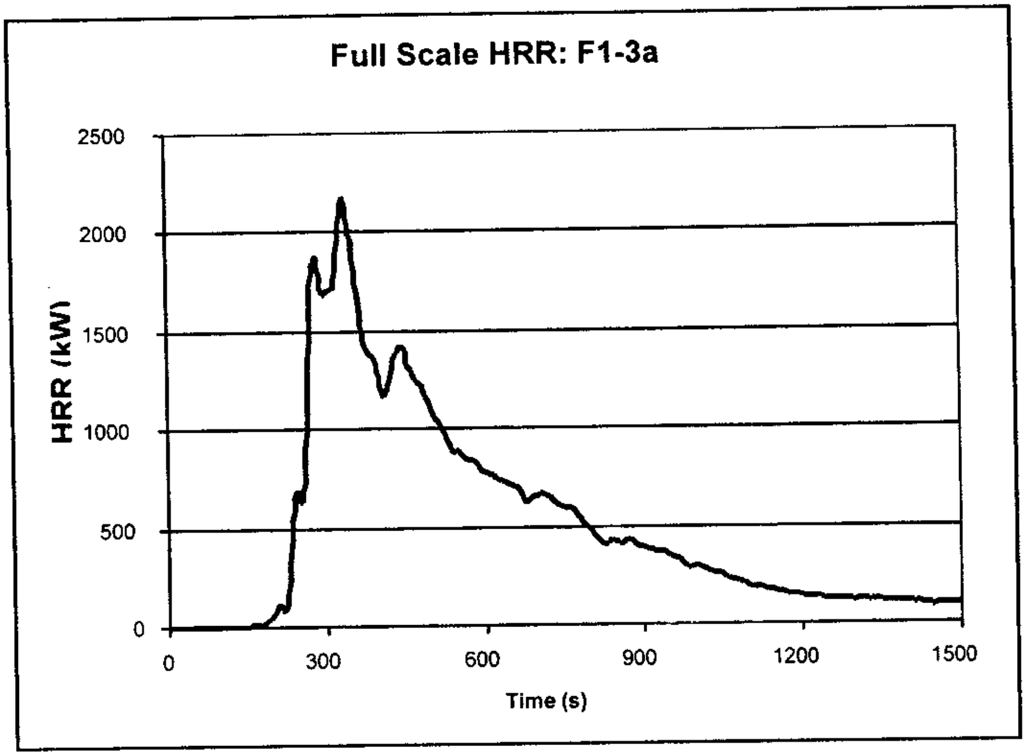
Compare L1 & L2 - Series 7
300
200
100
0
HRR (kW)
0
200
400
600
800
1000
1200
Time (s)
L1-
L2-

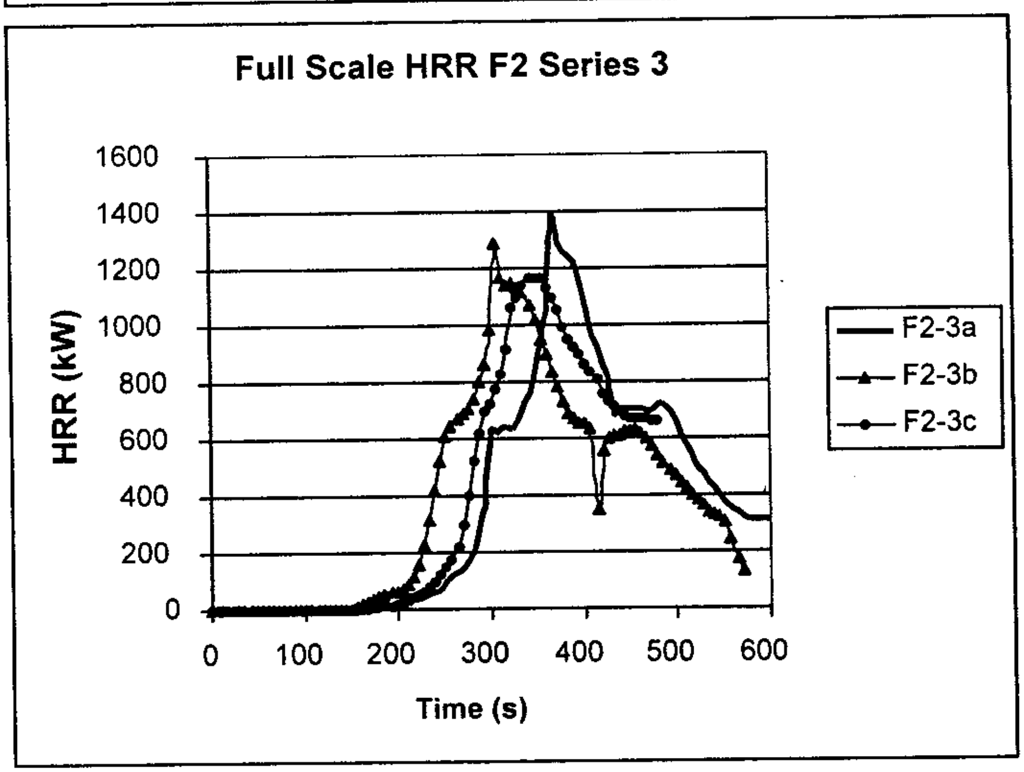


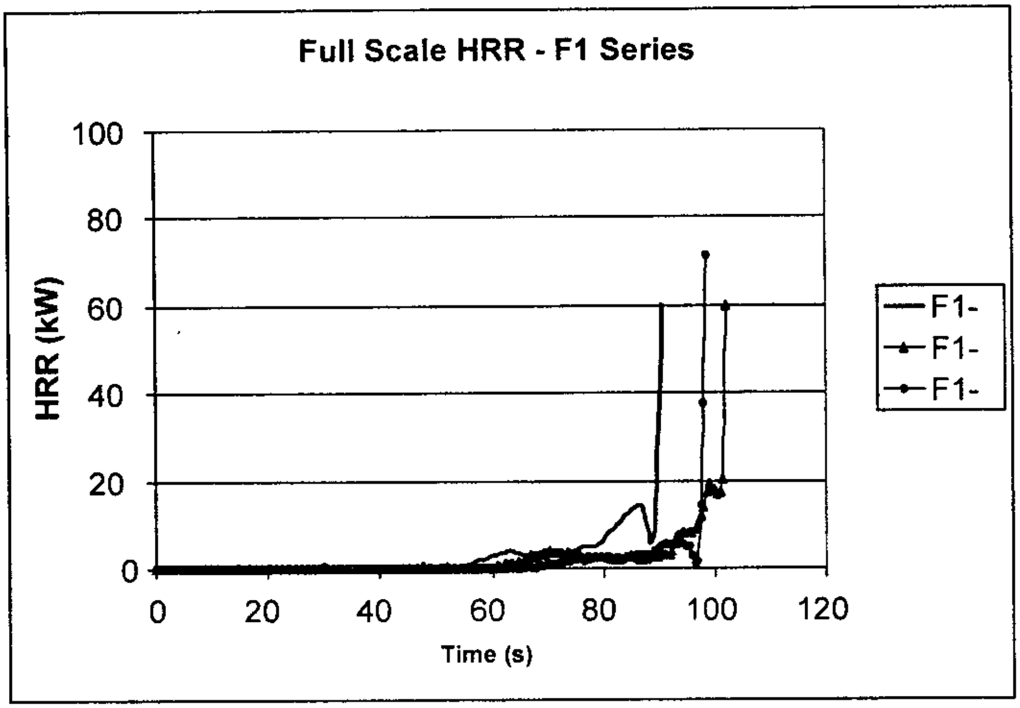
Selected Large Scale Tests-L1
600.0
500.0
400.0
300.0
200.0
100.0
0.0
HRR (kW)
0
200
400
600
800
1000
1200
Time (s)
L1-2b
L1-3a
L1-7b
L1-4a

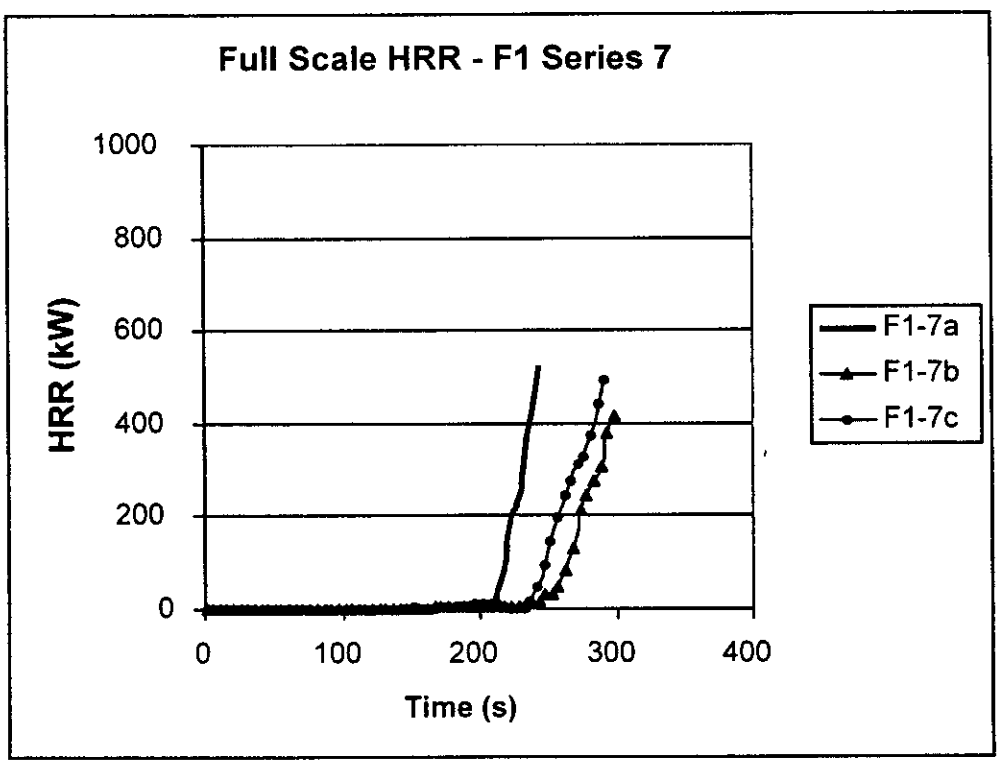

Full Scale HRR - F1 Series 2
HRR (kW)
1000
800
600
400
200
0
0
100
200
300
Time (s)
F1-2a
F1-2b
F1-2c


Full Scale HRR - F1 Series 3
HRR (kW)
1000
800
600
400
200
0
0
200
400
600
Time (s)
F1-3a
F1-3b
F1-3c


Full Scale HRR: F1-3a
HRR (kW)
2500
2000
1500
1000
500
0
0
300
600
900
1200
1500
Time (s)


Full Scale HRR F2 Series 3
HRR (kW)
1600
1400
1200
1000
800
600
400
200
0
0
100
200
300
400
500
600
Time (s)
F2-3a
F2-3b
F2-3c


Full Scale HRR - F1 Series
100
80
60
40
20
0
HRR (kW)
0
20
40
60
80
100
120
Time (s)
F1-
F1-
F1-


Full Scale HRR - F1 Series 7
1000
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HRR (kW)
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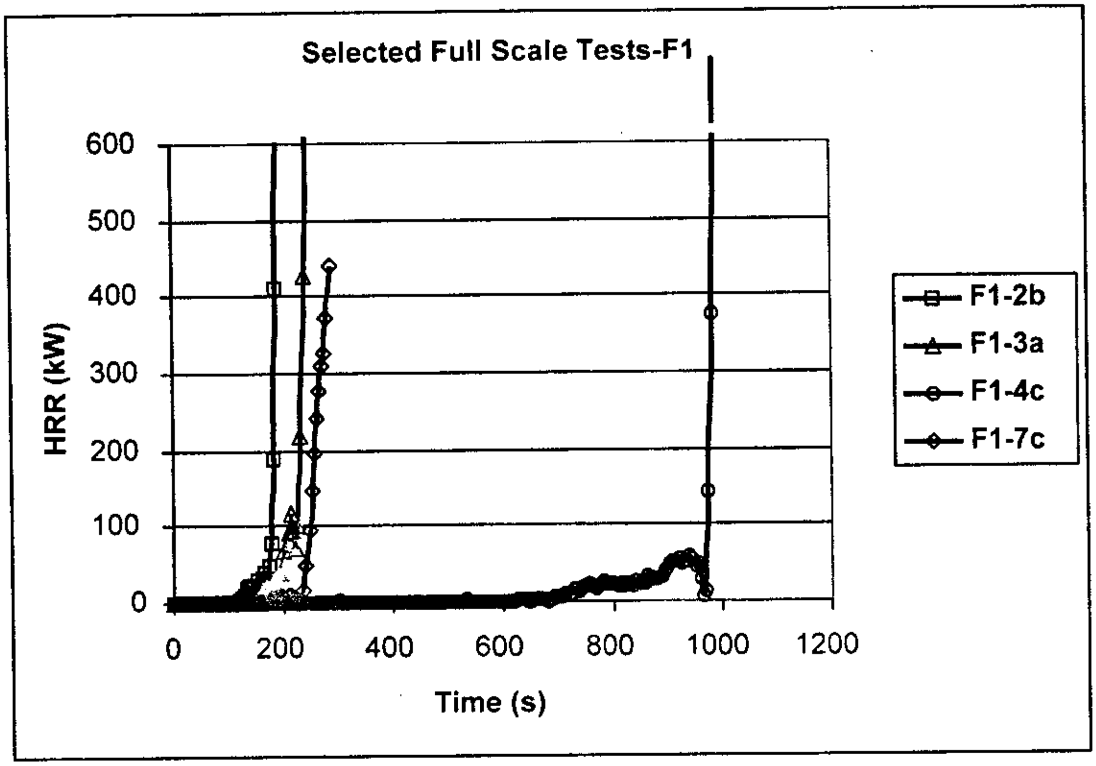
Time (s)
F1-7a
F1-7b
F1-7c


Selected Full Scale Tests-F1
HRR (kW)
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800
1000
1200
Time (s)
F1-2b
F1-3a
F1-4c
F1-7c

National Furniture Flammability Proposal

National Furniture Flammability Standard

Fabric Coalition Proposal

Consumer Product Safety Commission

Bethesda , MD
March 1, 2004

National Furniture Flammability Proposal

"A Balanced Approach"

National Furniture Flammability Proposal

The Objectives:

Applicable

1. Is effective in reducing the frequency and severity of upholstered furniture fires;
2. Complements the results currently being achieved with the UFAC program;
3. Avoids the kinds of unintended safety consequences that can sometimes follow initiatives like these;

Practical

1. Allocates the burden of compliance, in an equitable way, among all stakeholders in the supply chain;

National Furniture Flammability Proposal

The Objectives:

Practical (cont.)

2. Does not involve costly, overly burdensome administrative and compliance systems;
3. Has minimal impact on the price the consumer ultimately pays for compliant furniture;
4. Meets consumer expectations with respect to: the look, the feel, and the variety of upholstered furniture products;
5. Provides a level playing field among domestic and foreign fabric and furniture manufacturers;

National Furniture Flammability Proposal

The Objectives:

Technically Achievable

1. **Employs technologies that are currently available to every stakeholder throughout the furniture supply chain;**

National Furniture Flammability Proposal

"The Proposal"

National Furniture Flammability Proposal

The Proposal:

1. **Seat Cushion Core Materials** -All foam must meet the revised TB-117 standard. Seat cushion cores made of other materials must pass an equivalent standard.

2a. **Cover fabrics** - would be required to meet either of the following two criteria, after exposure to a 5.0 second SOF – *Class I.*

   2.1. Fails to ignite, or self-extinguishes
   2.2. Average flame spread is slower than 30.0 seconds.

National Furniture Flammability Proposal

The Proposal:

2b. **SOF Barrier** – In lieu of a *Class I* cover fabric, an appropriate fire blocking system could be utilized. Foam requirements would remain "TB-117 Plus".

3. **Cigarette Ignition Resistance** - ASTM E-1353. Furniture to be assembled with Class A barriers, when constructed with *Class II* cover fabrics.

National Furniture Flammability Proposal

"Testing & Compliance Protocol"

National Furniture Flammability Proposal

Fabric Testing Procedure:

1. **Use standard 45 degree (TB-117) testing apparatus**
2. **Adjust flame impingement time to 5.0 seconds**
3. **Test 5 specimens each in warp and filling direction, face-up**
4. **If 8 of the 10 specimens *self-extinguish* (SE) or *do not ignite* (DNI) – sample is designated *Class 1***

National Furniture Flammability Proposal

Fabric Testing Procedure:

5. If < 8 specimens SE or DNI then calculate the average flame spread time. That is, the elapsed time in seconds, it required to burn through the stop cord. If the average flame spread time is > 30.0 seconds, then pattern is designated *Class I.*
6. If neither the criteria in 4. nor 5. are met, fabric is designated *Class II.*
7. Invoices, shipping manifests, and related documentation must reflect the *Class I/II* status of each SKU

National Furniture Flammability Proposal

Compliance Testing:

1. Test 2 specimens each in warp and filling direction, face-up.
2. If 3 of the 4 specimens *self-extinguish* (SE) or *do not ignite* (DNI) – classify as *Class I*
3. If < 3 specimens SE or DNI, then average flame spread of of specimens must be > 30.0 seconds, to be classified as a *Class I*
4. Install quality systems preventing non-conforming products from inadvertently being shipped. (See ISO 9001:2000)
5. Sampling plans must be established to ensure that products and processes are within a state of statistical-process-control. (See ANSI/ASQC Z1.4-1993, or ISO 2859 for guidance.)

National Furniture Flammability Proposal

Import Compliance Testing:

1. **Reasonable quality and process control systems be installed, to prevent non-conforming products from entering the stream of commerce.**

2. **Compliance documents (test certificates, quality audits, shipping manifests, etc.) maintained within the US, by importer of record.**

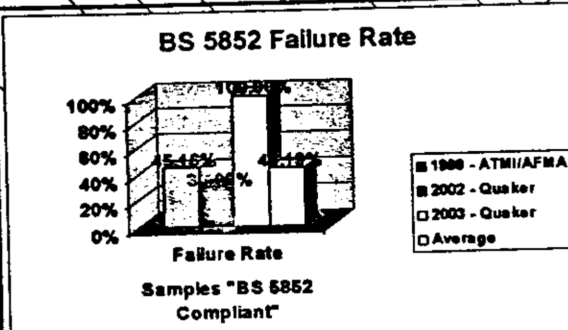
National Furniture Flammability Proposal

"Why Replicating BS 5852 is not the Ideal Solution"

National Furniture Flammability Proposal

Concerns for CPSC's SOF:

1. It presumes the BS 5852 standard has been working well in the UK, when in fact, the reality is that random compliance checks reflect compliance rates of approx. 50%.



National Furniture Flammability Proposal

Concerns for CPSC's SOF:

2. The testing protocol calls for an unrealistically long flame exposure time of twenty seconds.

3. Heavy amounts of FR chemicals are necessary to enable some fabrics to eventually pass, some of the time.

National Furniture Flammability Proposal

Concerns for CPSC's SOF:

5. **Fabric selection is limited and fabric costs are increased significantly, due to the intense engineering effort necessary to get each of the estimated 500,000 fabric SKUs currently sold in the U.S. market to pass.**
6. **The cost of furniture at the consumer level increases dramatically due to the significant investment initially required to prepare the industry for compliance, and the annual cost of compliance.**

National Furniture Flammability Proposal

"Benefits of the Fabric Coalition's Solution"

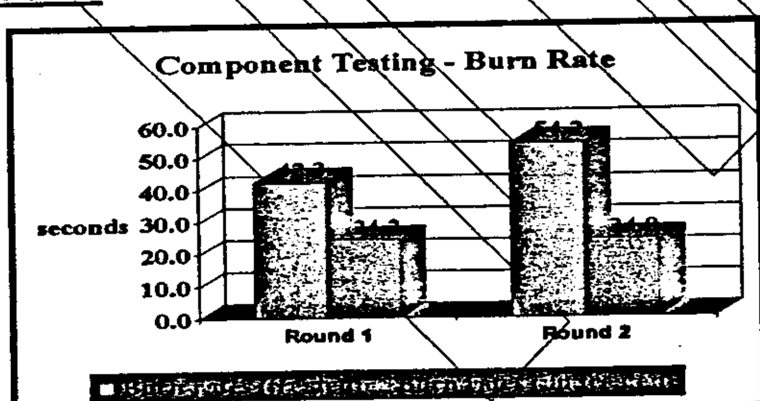
National Furniture Flammability Proposal

Benefits:

1. **A national standard that is superior to California's current TB-117, which when implemented will not only replicate, but greatly enhance California's experience on a national level.**

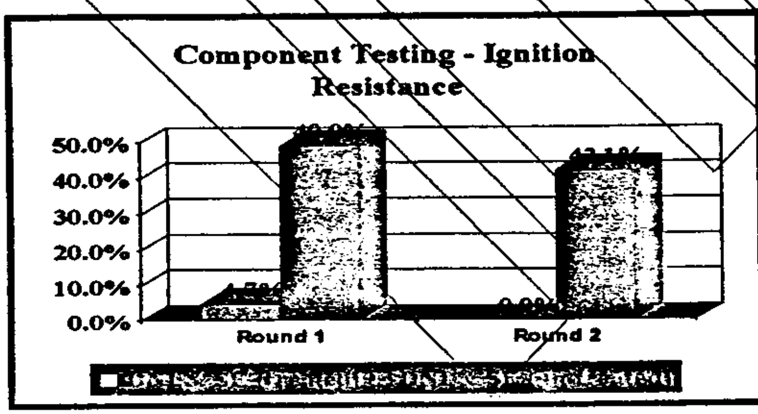
National Furniture Flammability Proposal

Benefits:



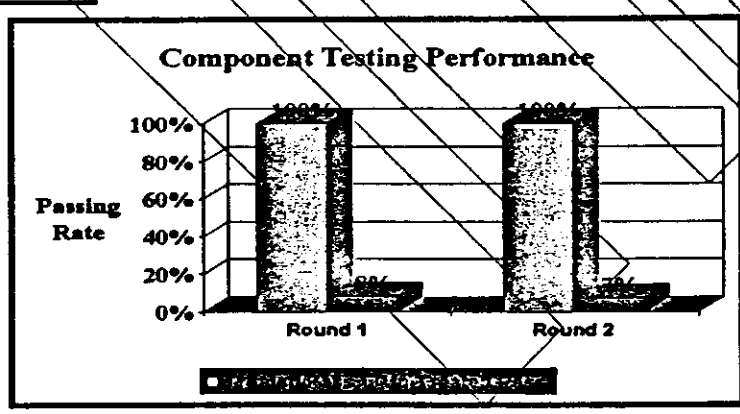
National Furniture Flammability Proposal

Benefits:



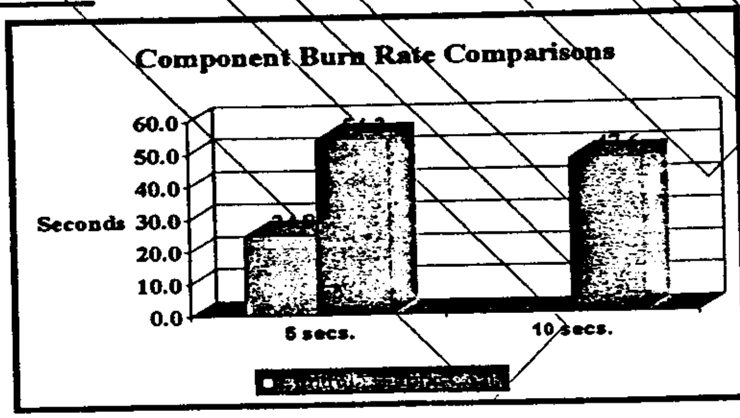
National Furniture Flammability Proposal

Benefits:



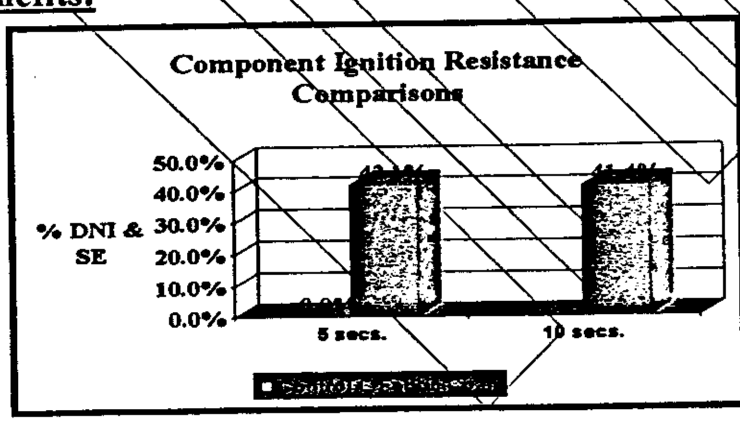
National Furniture Flammability Proposal

Benefits:



National Furniture Flammability Proposal

Benefits:



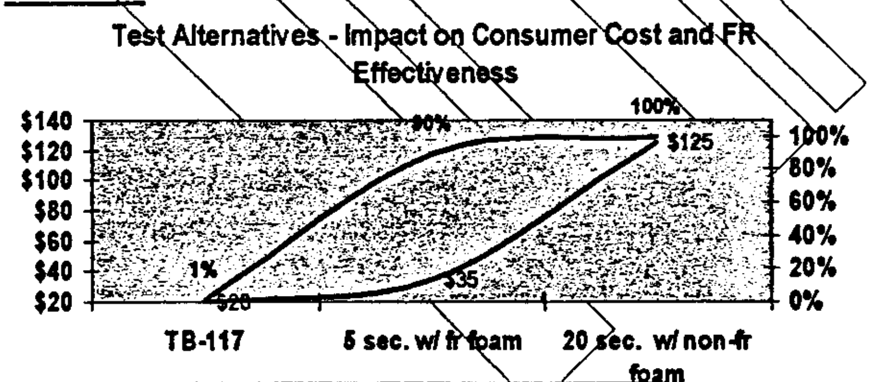
National Furniture Flammability Proposal

Benefits:

2. A national standard that takes advantage of currently available technology and is minimally disruptive to furniture and textile manufacturers.
3. A national standard that shares the burden of compliance equitably among all of the stakeholders in the furniture supply chain.
4. A national standard that will have the least financial impact on the consumer, compared to the other options currently under consideration.

National Furniture Flammability Proposal

Benefits:



National Furniture Flammability Proposal

Benefits:

5. A national standard that is both economically responsible and feasible to implement and administer – with minimal risk of further job losses and bankruptcies within the industry.

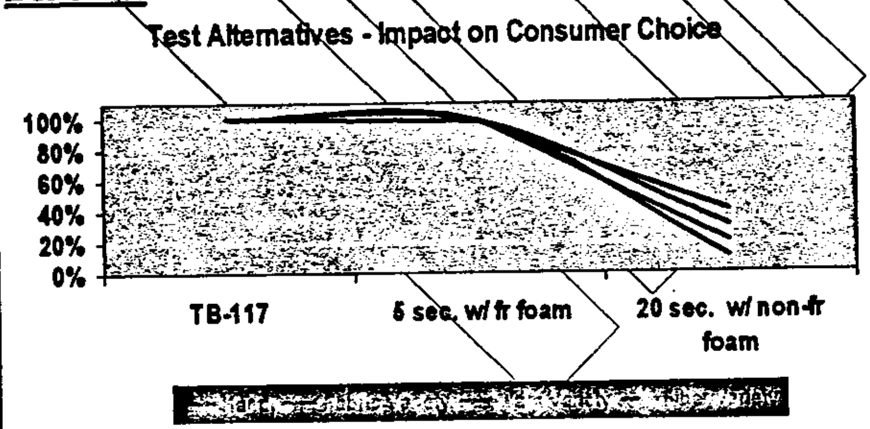
National Furniture Flammability Proposal

Benefits:

6. A national standard that will continue to afford the upholstered furniture industry the opportunity to offer consumers a wide range of fabric choices and furniture that has the look and feel they have come to expect.

National Furniture Flammability Proposal

Benefits:



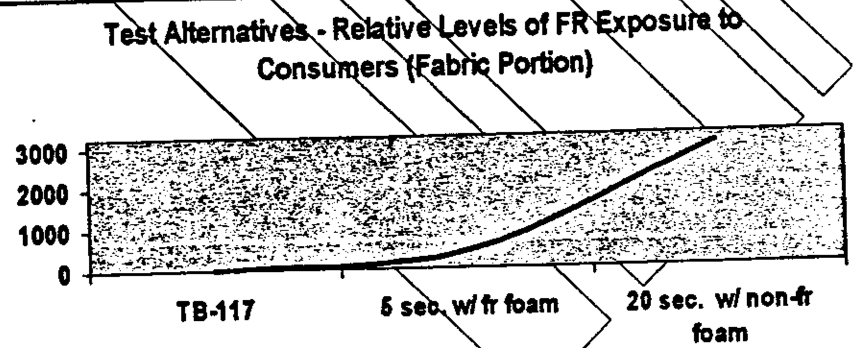
National Furniture Flammability Proposal

Benefits:

7. **A national standard that, in comparison to the other options currently under consideration, reduces > 7 fold consumers' exposures to FR chemicals.**

National Furniture Flammability Proposal

Benefits (round 1 & 2):



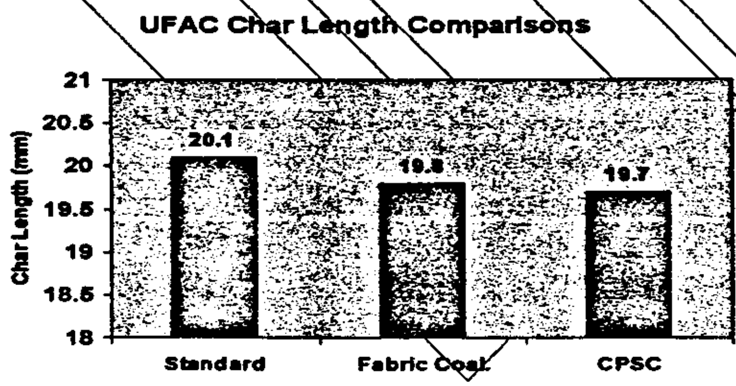
National Furniture Flammability Proposal

Benefits:

8. A national standard that complements the success of the UFAC program.

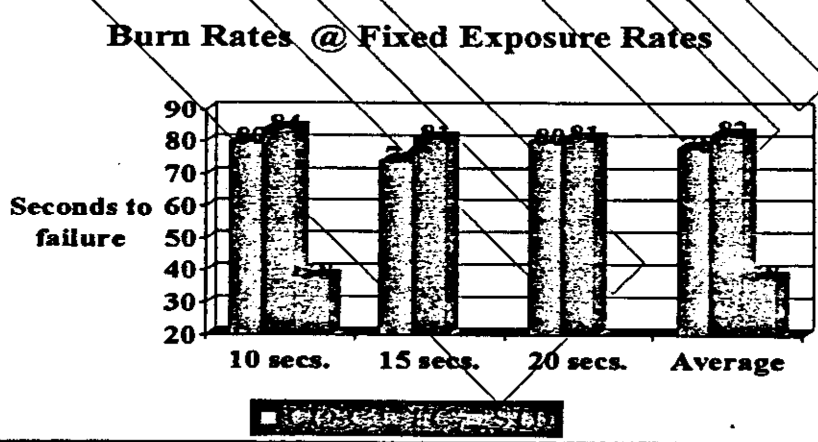
National Furniture Flammability Proposal

UFAC:



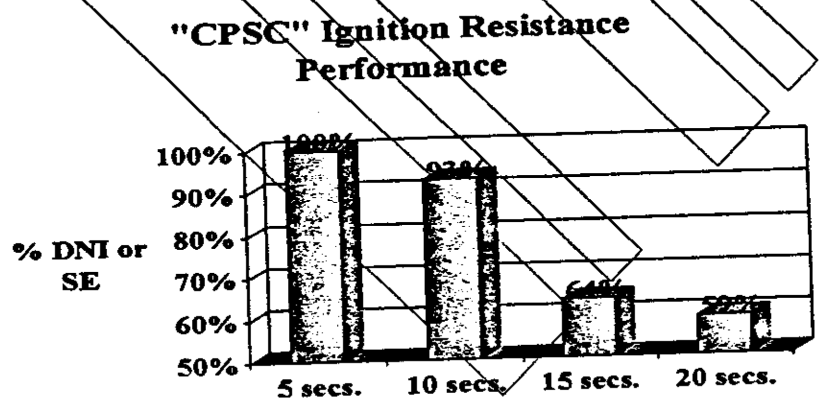
National Furniture Flammability Proposal

Burn Rate - Composite Comparison (R2):



National Furniture Flammability Proposal

Ignition Resistance - Composite Comparison (R2):



National Furniture Flammability Proposal

Questions & Comments:

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CULP INC.'S COMMENTS ON THE FABRIC COALITION PROPOSAL FOR UPHOLSTERY FLAMMABILITY

Presented to the C.P.S.C.
Bethesda, Maryland
March 1, 2004

March 1 2004

GENERAL COMMENTS

1. Culp, Inc. supports the Fabric Coalition proposal.

2. In general, Culp, Inc. has found the test results presented by the Fabric Coalition confirms our burn results.

3. Culp Inc. sells a wide range of fiber types. The products can be 100% one fiber however, they are generally blends. Our volume is centered around blends of olefin, polyester, acrylic, and to a less degree, cotton

4. We have made the following observations:

   A. The higher the fabric's cellulosic content the better the test results.

   B. To meet the Fabric Coalition proposed test method: Culp Inc. would need to treat (with an F.R. process) approximately 85% of our current volume.

   C. We have seen significant differences in test results between warp and fill specimens.

California Furniture Manufacturers Association

March 10, 2004

Honorable Hal Stratton
Chairman
U.S. Consumer Product Safety Commission
4330 East West Highway
Bethesda, MD 20814

Dear Chairman Stratton

California Furniture Manufacturers Association endorses the upholstered furniture flammability standard as proposed last week to the U.S. Consumer Products Safety Commission. This proposal was developed by a coalition of textile producers representing over one-half of the volume of goods produced.

We have joined forces with the Upholstered Furniture Action Council (UFAC) and the American Furniture Manufactures Association (AFMA) and support the coalition's solution as a workable and reasonable solution.

In May 2002 our association made a commitment to support a national fire safety standard for upholstered products. We are encouraged this proposal can become the national standard.

Scott Haigh

Scott Haigh
President CFMA

cc: Dale Ray CPSC
Andy Counts AFMA
Russell Batson AFMA
Joe Ziolkowski UFAC

1240 N. Jefferson St., Suite G • Anaheim, CA 92807 • (714) 632-6800 • Fax (714) 632-5405

AFMA

May 13, 2004

The Honorable Hal Stratton
Chairman
U.S. Consumer Product Safety Commission
4330 East-West Highway
Bethesda, MD 20814

Dear Chairman Stratton:

Over the last two years, stakeholders have traded a series of proposals designed to assist the Commission in completing an effective and workable regulation of upholstered furniture flammability. The following proposal builds upon that constructive dialogue, and reflects the insight of producers of furniture, fabrics and cushioning materials, as well as input from CPSC staff, testing labs and fire safety advocates both in and out of government. We are convinced it represents a cost-effective, risk-based approach to the most likely ignition scenarios for both small open flame and cigarettes.

The framework envisions an equitable sharing of the burden of fire resistance between the various elements of the upholstered furniture supply chain. The distribution of responsibility among industry stakeholders allows for more attainable performance requirements for individual components and should also introduce a degree of safety redundancy into the construction of furniture.

Cost-effective doesn't mean cost-free. Furniture manufacturers will likely see price increases for reformulated foam and chemically backcoated fabrics, and perhaps some loss of aesthetics from the replacement of siliconized cushion wraps and toppers with less flammable alternatives. More substantial costs are expected in connection with flame-blocking barriers used beneath untreated fabrics. Suppliers of both upholstery fabrics and cushioning will incur R&D and testing expenses as they revamp their products to pass the proposed flammability tests, and to do so using safe and appropriate chemicals.

With these considerations in mind, AFMA would like to propose the following provisions as the basis of a mandatory flammability standard. We encourage other stakeholders to review these recommendations and to provide input to the Commission

1. For upholstery fabrics, the 5-second open flame fabric test utilizing the Technical Bulletin 117 test apparatus, as proposed by the Fabric Coalition. Non-passing fabrics or those for which FR treatment is not desired could be utilized atop an open flame barrier. CPSC is currently working to identify an appropriate test for such barriers.

2. For all foam (any type) used in upholstered furniture, the cigarette and open flame requirements contained in the proposed revision to California Technical Bulletin 117 ("TB-117+").

3. For all non-foam cushion core materials used in upholstered furniture, the cigarette and open flame requirements of TB-117+ or a comparable test method.

4. For non-foam seat cushion wrapping or topper materials, the requirements of the BS 5852 Source 2 *Test for Non-Foam Filling Materials*.

5. For any cotton batting used in upholstered furniture, the ASTM E 1353 test with maximum smolder length criteria specified by UFAC.

6. For all non-foam materials used in arm constructions, the filling and padding test of ASTM E 1353 with the maximum smolder length criteria specified by UFAC.

Confronted with such a collection of component standards, some readers may attribute a patchwork quality to the present proposal. In reality, the development and testing of its key elements by many parties over a period of years has yielded a combination of changes that are mutually supportive.

To cite one example, FR backcoating will likely represent the low-cost option for improving outer fabric performance. The thermoplastic fabrics that dominate the cost-conscious segment of the marketplace lend themselves readily to FR treatment because many are already latex backcoated for durability, and textile researchers believe resistance to the proposed five-second test can be achieved by inclusion of FR chemicals into the existing backcoating process.

At the upper levels of the market, where backcoating might undermine customer preferences regarding aesthetics and chemical use, an option to utilize chemically inert barrier materials is provided. Barriers could take the form of high loft batting and other materials that are already used in such products, minimizing additional labor. Further, while barriers currently represent a more costly option than backcoating, higher-end furniture producers likely to avail themselves of this approach might be better able to manage such costs. Providing two alternative approaches to outer fabric performance will also allow compliance strategies to adapt to changes in the fabric market and to the availability and cost of chemical treatments and barrier materials.

In drawing together these various provisions, efforts were made to eliminate contradictory requirements or duplicative testing. At one point, over a dozen separate test procedures had been proposed by industry stakeholders alone. Several of these tests are remnants of the UFAC program, which for various reasons we feel can be eliminated.

For instance, the heat-conducting UFAC welt cord was developed primarily for Class II fabrics, for which cigarette ignition was a primary concern. The welt cord test uses a standard Class II fabric in conjunction with conventional polyurethane foam. The declining prevalence of Class II fabrics, along with the proposed elimination of conventional foam, make this test outdated. Further, heat-conducting cord has virtually displaced other welt cord from the market on a cost-effective basis, and there is no reason to expect a reversal of this trend.

Likewise, today's decking materials are made from polyurethane and/or polyester. The elevated standards which AFMA has proposed for polyurethane and other non-foam cushioning materials will minimize the risks that the decking test was designed to address.

The UFAC classification test for outer coverings was embodied in earlier iterations of this proposal. As the draft framework broadened to include higher performance standards for non-foam filling materials, the Project Manager and other key stakeholders began discussions over whether that classification test was any longer relevant. Consider that the practical implications of Class II status are the requirement that a smoldering barrier be used between that fabric and any foam filling material. In the present proposal, equal [1] or superior [2] performance requirements would be demanded of batting materials regardless of outer fabric type. In addition, the relatively small proportion of Class II fabrics remaining in the marketplace tend to target middle and upper price points. To preserve aesthetic qualities critical to that segment of the market, these fabrics would likely be used in conjunction with an open flame barrier. [3] Such barriers serve a protective function resistance viz. both small open flame and smoldering ignition sources.

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1 See provisions 5 and 6, above. The retention of the UFAC cigarette test for non-foam cushioning in arm constructions recognizes that this area is a foreseeable resting point for dropped cigarettes, but is not identified in the agency's incident reports as a significant site of SOF ignitions.

2 See provision 4, above.

3 See provision 1, above.

In conclusion, AFMA is convinced that this framework will achieve meaningful safety gains while retaining the fabric choice, comfort and affordability that consumers demand. We respectfully urge CPSC to conduct the appropriate analysis and validation of this proposal, and to provide for its consideration by the Commission as the basis of a Notice of Proposed Rulemaking.

Please contact me if the association can be of assistance to the agency in accomplishing this goal.

Sincerely,

Andy

Andy S. Counts
Chief Executive Officer

Cc: The Honorable Thomas Moore
The Honorable Mary Sheila Gall
Mr. Dale R. Ray, Project Manager

20

National Textile Association

6 Beacon Street • Suite 1125 • Boston, Massachusetts 02108

617-542-8220 • info@nationaltextile.org • www.nationaltextile.org • 617-542-2199 fax

May 27, 2004

The Honorable Hal Stratton
Chairman
Consumer Product Safety Commission
4330 East-West Highway
Bethesda, Maryland 20814

Re: Upholstered Furniture
Flammability Standard

Dear Chairman Stratton:

I am writing in support of the proposal described in the American Furniture Manufacturers Association's May 13, 2004 letter to you regarding a mandatory flammability standard on upholstered furniture. The National Textile Association is the largest association of textile companies in the U.S. Members are active in every sector of the textile industry, as well as related supplier industries.

The upholstery fabrics sector of the textile industry, represented by our Upholstery Fabrics Council, has been deeply involved in development of the fabric classification portion of the proposal. After an enormous amount of study and review, we conclude that the test method represents a reasonable and technically feasible approach to evaluating the flammability of furniture fabrics, and is an integral part of the overall furniture flammability proposal. NTA is currently managing a round robin evaluation of the fabric test method, which includes testing by CPSC's lab, and will provide an analysis of the data once it's complete.

A coalition of furniture manufacturers and its many suppliers have developed the AFMA proposal. In our opinion, it represents the most complete proposal advanced by any organization since the federal government began its review of the issue three decades ago.

We are pleased to be supporters of this proposal and look forward to moving to a formal rulemaking process based on the AFMA proposal.

Please feel free to contact us if we can provide additional information of if you have questions regarding our position.

Sincerely,

Roger Berkley

Roger Berkley
Chairman
Upholstery Fabrics Council

Polyurethane Foam Association

Executive Offices
PO Box 1459 Wayne, NJ 07474-1459
Telephone 973-633-9044
Fax 973-628-8986
E-mail loupeters@pfa.org

June 4, 2004

Honorable Hal Stratton
Chairman
U. S. Consumer Product Safety Commission
4330 East-West Highway
Bethesda, MD 20814

Dear Chairman Stratton:

On behalf of the Polyurethane Foam Association (PFA), I am writing you to express PFA's support for the proposal put forward in a letter to you dated May 13, 2004 by the American Furniture Manufacturers Association (AFMA), which is designed to assist the Commission in completing an effective and workable regulation of upholstered furniture flammability.

PFA concurs with AFMA, UFAC, the fabric coalition, and other organizations on the desirability of developing a uniform national standard for the flammability of upholstered furniture. Accordingly, PFA has worked diligently with other stakeholders to try to develop a consensus for a national flammability standard. There appears to be growing consensus that any flammability standard should consider the hazards posed by a finished article, which in the AFMA proposal will be addressed by requiring all major components to meet individual flammability tests.

Since the AFMA proposal requires individual flammability tests for all major components, the burden of providing fire resistance of upholstered furniture will not fall primarily upon any one component. The various flammability tests proposed for individual components, including upholstered fabrics, flexible polyurethane foam, non-foam cushioning core materials, non-foam seat cushioning wrapping or seat crown materials, cotton batting, and all non-foam materials used in arm constructions, sides and front aprons, appear to be reasonable, reproducible, predictable, and technically feasible. Since these components make up a substantial portion of an article of upholstered furniture, they should significantly influence the fire performance of a finished article of upholstered furniture in a real-fire situation. The proposal also addresses the PFA's concerns that there be no discrimination among components; i.e., that some components not be required to meet any flammability standard.

The proposed approach suggested by AFMA permits a variety of compliance options, which will provide greater flexibility and accommodate improved technology for compliance purposes. We encourage the CPSC to consider seriously the AFMA's proposal and to conduct the appropriate analyses and validation of the proposal for its consideration by the Commission as the basis of a Notice of Proposed Rulemaking.

Sincerely,

Louis H. Peters
Executive Director

cc: Honorable Thomas Moore
Honorable Mary Sheila Gall
Mr. Dale R. Ray, Project Manager

June 15, 2004

NOTICE OF PUBLIC CONSIDERATION OF PROPOSED NATIONAL CONSENSUS POSITION ON SAFE USE OF POLYURETHANE FOAM AND FILLINGS USED IN HOME FURNISHINGS

The National Association of State Fire Marshals (NASFM) membership consists of senior public safety officials from the 50 states and District of Columbia. NASFM's mission is to protect life, property and the environment from fire and other hazards.

On the morning of Saturday, July 10, 2004,[1] NASFM will consider formal adoption of the following statement, which has been proposed by the NASFM Consumer Product Fire Safety Task Force, in consultation with the Association's Science Advisory Committee.

> *Polyurethane foam and comparably combustible fillings used in upholstered furniture and mattresses are too dangerous for use in the home, unless they are treated to resist fire or are safely encapsulated. We have no evidence to the contrary. Manufacturers who choose to use these materials inappropriately do so with the knowledge that they are placing their customers at risk of death and serious injury. NASFM urges the use of only fire-resistant or safely encapsulated fillings for the manufacture of upholstered furniture.*

If adopted, this consensus policy will be distributed to all interested parties with the intent of immediately reducing the risk posed by these materials.

Written comments will be accepted in electronic format until close of business, Thursday, July 1, 2004, by responding to this e-mail. Within the time allotted for this discussion, we will permit 3-minute oral summaries of written comments on a first-come, first-served basis. A vote of the NASFM membership will follow immediately after the discussion.

Please note, NASFM's decision to begin addressing the risks posed by individual groups of materials does not in any way undermine its commitment to achieving effective national standards that address the finished product fire performance of upholstered furniture and mattresses.

Taken in combination with our collective efforts on the health and environmental consequences of fire safety technologies, we believe that this approach is the most responsible step possible at this time.

James Narva, Chairman
Consumer Product Safety Task Force
June 15, 2004

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[1] This discussion is being held in conjunction with the NASFM annual meeting. For more information, please visit our website at www.firemarshals.org

3

ISPA

INTERNATIONAL SLEEP PRODUCTS ASSOCIATION

PFA

Polyurethane Foam Association

National Textile Association

AFMA

UFAC℠

CCDF

Coalition of Converters of Decorative Fabrics

DFA Decorative Fabrics Association

AFSC

July 12, 2004

Honorable Hal Stratton
Chairman
U.S. Consumer Products Safety Commission
4330 East-West Highway
Bethesda, MD 20814

Dear Chairman Stratton,

We feel that during your tenure as Chairman of the Consumer Product Safety Commission (CPSC), the agency has made substantial progress toward establishing effective national flammability standards for furniture and mattresses. There is still work to be done, but we feel there is a general consensus that such standards will in fact be put in place, the only question is the timeframe. The American Home Fire Safety Act has drawn an added focus to these issues on the part of a broader audience. We are confident that the CPSC will follow through on its commitment to improving consumer safety for these products as it proceeds with its rulemaking process.

The undersigned stakeholders have engaged in flammability testing and a constructive dialogue which has resulted in substantial consensus about how to effectively regulate these products. We hope our cooperative efforts will assist the Commission in its efforts to finalize these standards. Of course, there are still issues to be worked out and further validation will be required, but we have tried to structure a proposal that will be effective in offering a significant level of increased fire safety for the public, one that is practical to implement, and one that will not place an undue economic burden on manufacturers, consumers or U.S. jobs.

Regarding the furniture flammability standards, we feel the American Furniture Manufacturers Association (AFMA) proposal outlined in the May 13th memo from Andy Counts to you is a viable proposal. It provides for FR treatment for all polyurethane foam and non-foam materials used in furniture construction. It also provides for flame testing of fabric and cushion wraps, and an alternative construction method utilizing flame-blocking interliners. The undersigned stakeholders feel the AFMA proposal would result in meaningful safety gains, be implemented in a realistic timeframe, and offer consumers more reliable compliance, greater affordability and broader fabric choice than some of the proposed alternatives. There remains some difference of opinion on the part of some stakeholders regarding the duration of the open flame fabric test, but we expect this issue to be resolved through further testing and analysis.

Regarding the mattress flammability standard, we feel that the final standard adopted by California, Technical Bulletin 603, is a landmark development in addressing open-flame ignitions of mattresses and will provide a significant improvement in fire safety. A previous California draft proposal (issued in February 2003) which called for extended flame test times is not practical to implement. Furthermore, no scientific research demonstrates that it would provide a significant level of increased fire safety over the adopted standard. Our proposal would therefore be for the CPSC to use the adopted TB603 as a basis for a national standard. There is a difference of opinion about the need for flame retardant treatment of polyurethane foam in these applications; however, once again, we expect further testing and analysis to resolve this issue.

We respectfully ask CPSC to consider our comments in its development of national flammability standards for furniture, bedding and bedclothes.

Sincerely,

Lou H. Peters
Executive Director
Polyurethane Foam Association

Ryan Trainer
Executive V.P. & General Counsel
International Sleep Products Association

Andy S. Counts
Chief Executive Officer
American Furniture Manufacturers Association

Mark Buczek
Chairman
American Fire Safety Council

Gerard Wilder
President
Decorative Fabrics Association
& for the Coalition of Converters of Decorative Fabrics

Joe Ziolkowski
Executive Director
Upholstered Furniture Action Council

Carl Spilhaus
President
American Textile Association

cc: The Honorable Thomas Hill Moore
The Honorable Mary Sheila Gall
U.S. Senate Committee on Commerce, Science and Transportation

Report on Five Second Burn Tests of Furniture Composites
October 5, 2004

Nine representative fabrics were selected for these tests. Controls were run on each fabric consisting of: (1) Non-FR fabric and Non-FR foam (2) Non-FR fabric, Non -FR foam, and slickened P.E.T. batting on the seat portion of the mock-up only. In most cases, a sample of FR fabric over FR foam was tested; and in all cases, a sample was tested consisting of FR fabric, FR foam, and non-slickened P.E.T. batting placed in the seat portion of the mock-up only. All tests were performed at the Quaker Fabrics Corporation burn-test laboratory. Following is a summary of the data from the tests:

Legend:

Control 2: Non-FR Fabric, Slickened P.E.T. Batting, Non-FR Foam
DNI: Did Not Ignite
SE: Self-Extinguished.
FR Foam: All FR foam is TB-117Plus foam.
All non-slickened P.E.T. fiber was certified by Diversified Laboratories as passing Source #2 BS5852

Pattern Salisbury:

- UFAC Class I
- Wgt. 11.4 oz;[1]
- Fiber content: 55% P.E.T.; 31% acrylic; 14% olefin;
- 5 second burn rating, non-treated fabric only: 31.8 seconds
- 5 sec. Burn rating, FR treated fabric only 104 s
- Mockup Results:

1. Control: Non-FR fabric, Non-FR Foam, ignited and burned rapidly
2. Control 2: Non-FR fabric, Non-FR foam. slickened P.E.T. batting, ignited and burned rapidly.
3. FR fabric, FR foam, 3 DNI
4. FR fabric, FR foam, and non-slickened P.E.T. batting on seat only: 3DNI

[1] All weights reported are in ounces per square yard.

Silk Fabric[2]:

- UFAC Class I
- Wgt. 9.7 oz,
- Fiber content: 57% /rayon viscose, 43% P.E.T.
- 5 second burn rating, non-treated fabric only: 16.1 seconds
- 5 second burn rating: FR treated fabric 44.8 s
- Mockup Results:

    1. Control: Non FR fabric, non FR foam: Ignited and burned fairly slowly but completely on vertical
    2. Control 2: Non-FR fabric, Non-FR foam. slickened P.E.T. batting: One DNI and One Ignited and burned rapidly
    3. FR Silk, FR foam: Ignited with slow burn to ultimate S.E.
    4. FR Fabric, FR Foam, non-slickened P.E.T. batting: 2 DNI & One SE

Pattern Stapleton:

- UFAC Class I
- Wgt. 8.5 oz.,
- Fiber content: 42% P.E.T. 33% acrylic, 25% olefin
- 5 second burn rating, non-treated fabric only: 29.5 seconds
- 5 second burn rating, FR treated fabric only: 89.1 s
- Mockup results:

    1. Control, non-FR fabric, non-FR foam: Ignited and burned rapidly
    2. Control 2: Non-FR fabric, Non-FR foam, slickened P.E.T. batting: Ignited and burned rapidly.
    3. FR fabric, FR foam: 3 DNI
    4. FR fabric, FR foam, non-slickened P.E.T. batting on seat portion only: One DNI and one slow burn

[2] While this fabric is named "Silk," there is no silk fiber in the construction.

Pattern: Buckeye:

- UFAC Class I
- Wgt.9 oz.,
- Fiber content 70% olefin, 30% P.E.T.
- 5 second burn rating, non-treated fabric only: 23.9 seconds
- 5 second burn rating: FR treated fabric only 53.4 seconds
- Mockup results:

  1. Control non-FR fabric, non-FR foam: Ignited and burned rapidly.
  2. Control 2: Non-FR fabric, Non-FR Foam, slickened P.E.T. batting: ignited and burned rapidly.
  3. FR fabric, FR foam: One S.E. & 2 DNI
  4. FR fabric, FR foam, and non-slickened P.E.T. batting on seat only: One SE and One fairly slow burn.

Pattern Cedarhill:

- UFAC Class I:
- Wgt. 30.8 oz,
- Fiber content: 67% rayon, 24% acrylic, 9% cotton
- 5 second burn rate: 77 s on non-FR treated fabric only
- Mockup results:

  1. Control. non-FR fabric, non-FR foam: 3 DNI
  2. Control 2: Non-FR fabric, Non-FR foam, slickened P.E.T. batting: 3 DNI
  3. Non-FR fabric, FR foam, and non-slickened P.E.T. batting fiber on seat only: 3 DNI.

Pattern Chicopee:

- UFAC Class I
- Wgt. 7.2 oz.,
- Fiber content: 58% olefin, 40% P.E.T., 2% acrylic
- Five second burn rate, non-FR treated fabric only: 21.9 seconds
- 5 second burn rate: FR treated fabric only 77.8 seconds
- Mockup results:

  1. Control, Non FR fabric, Non FR foam: Ignited and burned rapidly
  2. Control 2: Non-FR fabric, Non-FR Foam, slickened P.E.T. batting: ignited and burned rapidly
  3. FR fabric, FR foam: 3 DNI's
  4. FR fabric, FR foam, with non-slickened P.E.T. batting on seat only: 3 DNI

Pattern Hinton:

- UFAC Class I
- Wgt. 7.4 oz
- Fiber content, 78% olefin, 22% P.E.T.
- 5 second burn rate, non-FR treated fabric: 38.1 seconds
- 5 second burn rate of FR treated fabric only: 63.2 seconds
- Mockup results:

  1. Control, non FR fabric, non FR foam, Ignited and burned rapidly
  2. Control 2: Non-FR fabric, Non-FR foam, slickened P.E.T. batting: ignited and burned rapidly
  3. Test using FR fabric, FR foam: 2 DNI & one slow burn
  4. FR fabric, FR foam, and non-slickened P.E.T. batting on seat only: 3 DNI

Pattern Interception:

- UFAC Class I
- Wgt. 16 oz
- Fiber content. 100% olefin
- 5 second burn rate of non-FR fabric only: 34.6 seconds
- 5 second burn rate, FR fabric: 104 s
- Mockup results:

    1. Control, Non-FR fabric, Non-FR foam, ignited and burned rapidly
    2. Control 2: Non-FR fabric, Non-FR foam, slickened P.E.T. batting: ignited and burned rapidly
    3. FR fabric, FR foam, 3 DNI
    4. FR fabric, FR foam, and un-slickened polyester fiber on seat: 3 DNI

Pattern K35892

- UFAC Class I:
- Wgt: 9.08 oz
- Fiber content, 100% cotton
- 5 second burn rating, untreated fabric 62 seconds. Av.
- Mockup results:

    1. Control, Non FR fabric, Non FR foam: 3 DNI
    2. Control 2: Non-FR fabric, Non-FR foam, slickened P.E.T. batting on seat only: 3DNI
    3. Non-FR fabric, FR foam, non-slickened polyester fiber on seat only. 3 DNI